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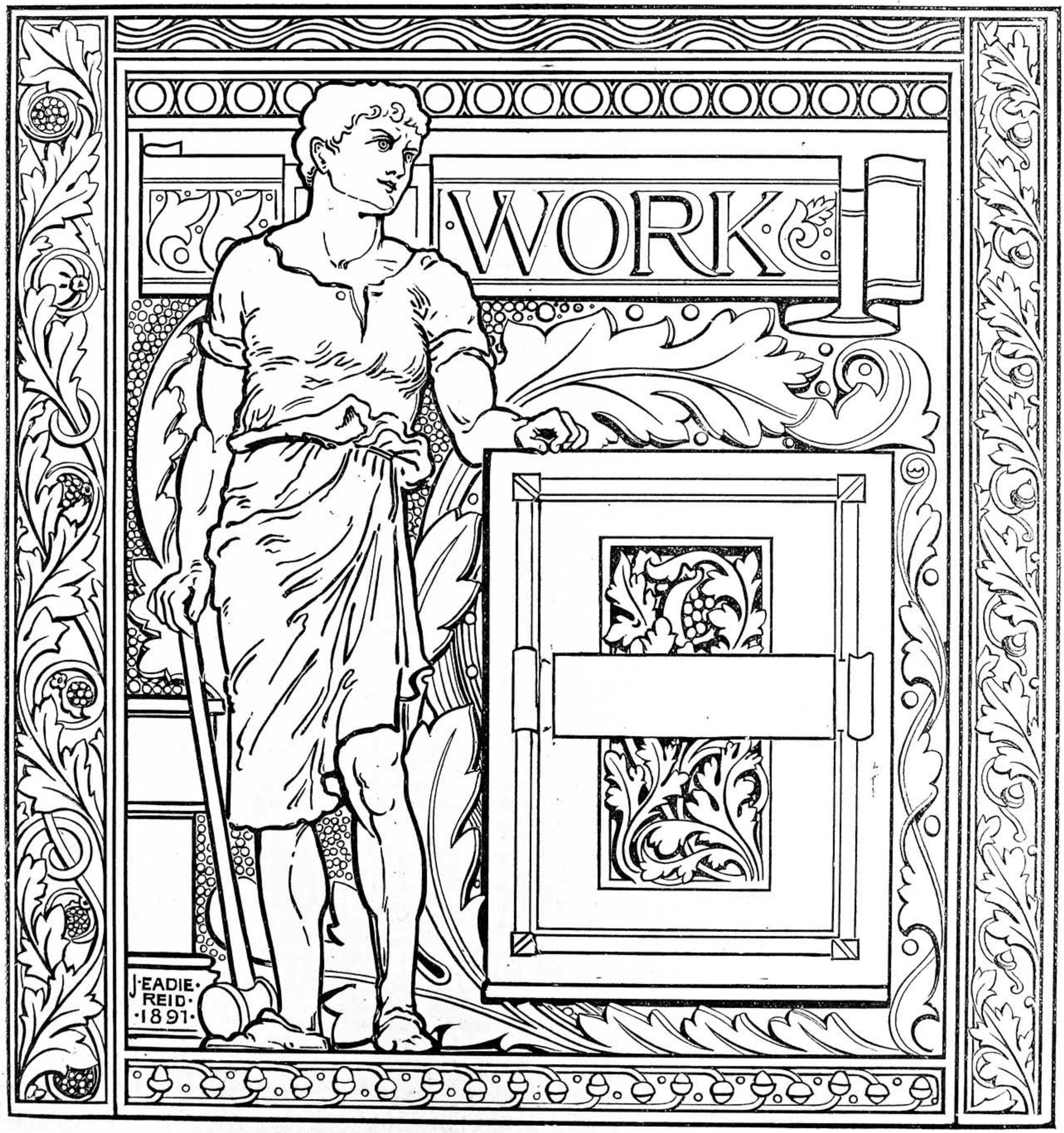
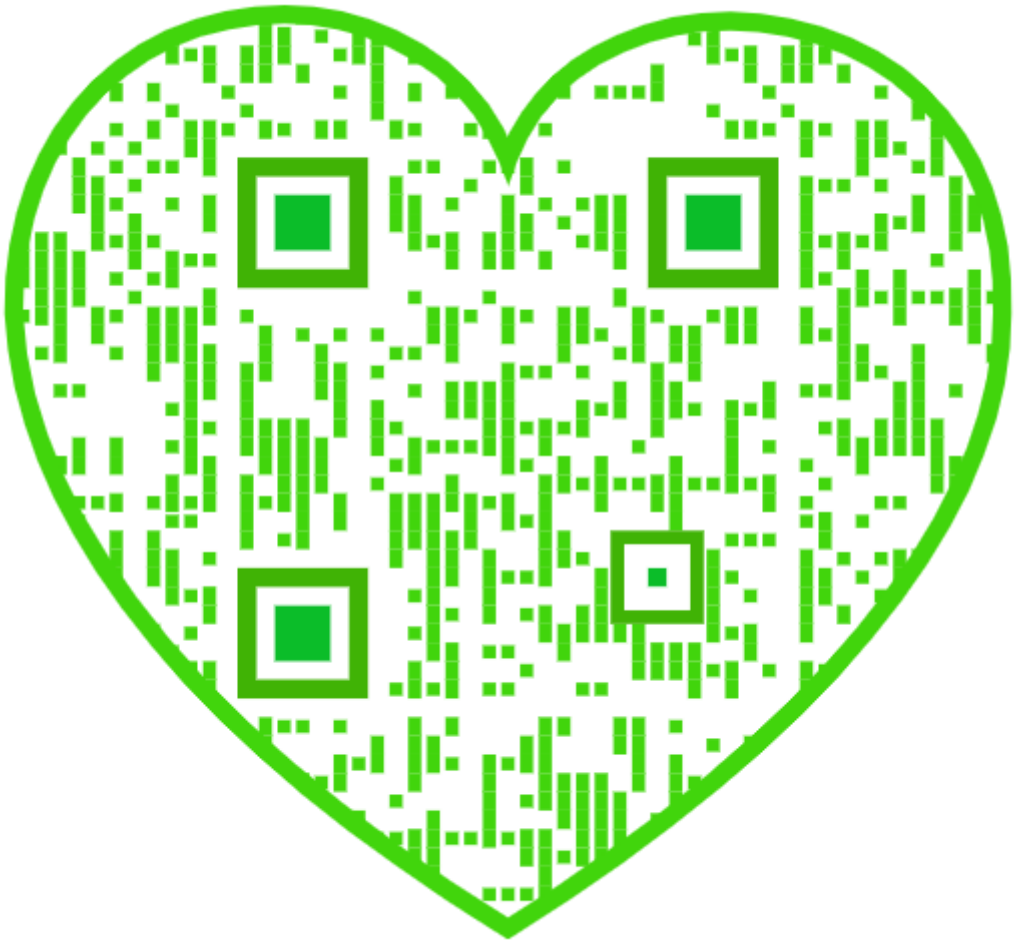


DESIGN FOR INCISED AND EMBOSSED ART WORK IN LEATHER.



DESIGN FOR ART WORK IN LEATHER.

BY J. EADIE-REID.

THE worker in leather, from the nature of his material, has before him an almost unlimited field for design. The wall-hangings, the tiny card-case, chair seats and backs, book-covers, etc., are all within his range. The quality of fineness in texture of the leather would of course be determined by the use for the article: pigskin, for instance, being preferable for dainty work, russet calf and such leathers answering for heavier articles.

The design which appears on the front page has been drawn specially as a cover for WORK. The block portion might be used as a card-case, while the borders will suggest many things to the worker.

The tools required are few and simple: a knife, a modelling tool, half a dozen ring tools, as shown at A in the accompanying illustration (these sizes will be found most useful), a few background tools, such as stars, shown at B, and a hammer. Having first sketched the design upon

Ring Tools (A), Star Tool (B), and Leather Ring (C), used in Leather Work.

the leather, cut the lines slightly into it with the knife, taking care not to go through. With a blunt tool then widen the cut, hammering the outer edge of the cut into the background, leaving the form standing in relief; to do this, the leather must be kept moist. The modelling and details can then be attended to and elaborated. In parts where "bossiness" is desired, it must be beaten up from the back. For this purpose it is necessary to have a few leather rings by you of varied size, as shown at C. Place the ring on the face of the form you wish raised, turn the leather carefully—seeing that the ring does not move—and beat into the ring (a blunt-headed tool will be useful for this). A paste made of bran put into the "bulge" will keep it raised; paper pasted over this again will keep the bran in place.

The design being now in a forward condition, it can be emphasised still more by giving texture to the ground. Star-shaped tools will now be found useful.

I have touched but lightly upon the salient points of the technique of this delightful craft. Experience alone will teach many of its subtleties—deftness will follow.

THE MYSTERIOUS OR GRAVITY CLOCK.

BY CHAS. A. PARKER.

DESCRIPTION OF MYSTERIOUS CLOCK—SELECTION OF WATCH MOVEMENTS FOR MOTIVE POWER—PREPARATION OF METAL HANDS—MAKING RINGS TO CONTAIN MOVEMENTS—ATTACHING RINGS TO HANDS OF CLOCK—FITTING COVERS TO RINGS—MAKING AND FITTING HOUR HAND WITH MOTIVE WEIGHT—WEIGHTING AND BALANCING HAND—WINDING AND SETTING HAND IN MOTION—MAKING, FITTING, AND ATTACHING WEIGHT TO MINUTE HAND—BALANCING, SETTING, TIMING, AND REGULATING HANDS—PREPARATION OF GLASS DIAL—CUTTING GLASS DISC—FITTING SPINDLE TO DIAL—PLATE-GLASS DIAL—FAINTING DIAL.

THE mysterious or gravity clock which is illustrated in Fig. 1 represents a large glass plate painted with figures similar to the dial of an ordinary clock and suspended by means of a pair of silken cords, which pass through a couple of holes in the outer edge of the plate. A short spindle is cemented into another hole situated in the exact centre of the plate, upon which a couple of thin metal hands revolve, entirely free from any visible wheels or works of any kind, which thus renders the clock a source of considerable wonderment to those who are unacquainted with its manner of working, and causing the fingers of the mechanically inclined to itch with a desire to dissect its mechanism. To most people there is something singularly attractive in watching the almost imperceptible movements of a clock of this description, in which the steady and regular motion of the hands would appear to be produced by some hidden power. In the present paper the writer proposes to give sufficient manipulatory details to enable anyone who patiently and thoughtfully carries them out to construct a clock of this description which will not only go, but likewise keep accurate time.

Having thus introduced the subject to the reader, let us now turn to the details of manipulation. The first requisite will be a couple of small ladies' Geneva watch movements (without the cases), and of a uniform size of about an inch or an inch and a quarter in diameter: the movements employed by the writer measure exactly 1¼ in. Watch movements such as these can generally be obtained for about 1s. each from any local watchmaker, or, failing this, no difficulty will be experienced in buying them at a gold- and silver-refiner's in any large town, as these people frequently throw away the movements when the watch-cases are broken-up for melting. It will be necessary to pick out a couple of tolerably fresh-looking movements, which will keep going in any position when wound up. It will also be requisite to see that the motion work under the dial is complete. In order that the tyro may be certain of this, it will be found advisable to pick out a couple of movements with the dial and hands perfect, although in actual work we shall require neither. Nevertheless, by adopting this course he can rest assured that the motion work will be perfect. It is also advisable, if possible, to have the stop work in proper order, as this will prevent the possibility of the mechanism being overwound, and will likewise ensure the two hands travelling for a uniform number of hours, for without a stop work it might so happen that one hand would run down before the other, as it must be understood that they work independent of each other. The stop work of a watch will always be found attached to the underside of the barrel, but this can only be seen by first removing the dial. An experienced hand can, however, tell whether the stop work is perfect by the feel of the key upon the winding-up squares. Assuming a couple of movements of this description to have been procured, it will be necessary to just see that they are both going to time, and, with this end in view, they may with advantage be wound up and kept going until ready to be fitted to the hands.

The next proceeding will be the preparation of a couple of full-size paper plans of the hands, of which a suitable pair are shown (half size) in Figs. 2 and 3, or an alternative design of a more simple form in Figs. 4 and 5. It may be stated that the first-named are outlined from the hands belonging to the clock made by the writer, but in Figs. 6 to 8 will be found three other alternative designs, either of which may be employed according to taste. Having decided upon the design, a couple of full-size plans of half of the hands longitudinally should be made upon a piece of paper of suitable size, which is then doubled lengthwise, in order that the complete hand may be carefully cut-out by means of a pair of scissors. The paper plans, when ready, are pasted on to a sheet of thin brass of sufficient size, which should then be very accurately pierced to the form of the outline by the aid of a fret-saw with a very fine blade, after which the sawn edges are carefully smoothed to the exact curves and lines by the use of a second cut or smooth, half-round file.

For the convenience of those who are unable to do the piercing themselves, it may not be out of place to mention that Mr. H. M. Hewitt, of St. James's Square, Clerkenwell, metal-piercer to the trade, will accurately pierce a pair of hands to the design of Figs. 2 and 3 for a small sum. Having got the hands pierced, a hole should be drilled through the exact centre of the middle boss of each one, into which the hour motion wheel of an old verge watch may be soft soldered, in order to form the bearings upon which the hand may turn. Any short length of tubing of small bore would, however, answer the purpose as well, but in this case the reader might experience some difficulty in getting the hand to run perfectly true, whereas the flat portion of a motion wheel as above described will be found to afford a certain amount of hold for the solder.

The writer would strongly advise the reader not to make the hands of a smaller size than the plans given in Figs 2 and 3, as it would give the boxes containing the mechanism the appearance of being greatly out of proportion to the size of the hand, thus betraying their manner of working. Before proceeding further, the two watch movements should be made to fit tightly into a couple of half-inch lengths of thin brass tubing of sufficient diameter to contain them, both edges of each ring of tubing being accurately turned up in a lathe. An experienced hand in this case can dispense with the ready-made tubing by turning up a couple of half-inch strips of thin sheet brass and turning them into the form of a pair of rings of a suitable size to hold the watch movements, afterwards joining the two ends together with hard solder. On examining the outer edges of the movements the reader will doubtless find two or more small projecting brass pins, which have formerly served as an aid to fixing the watches in the case. By withdrawing these pins the movement may be made to fit closely into the metal ring, and when the latter has been attached to the hands, holes may be drilled through the sides of the rings, in order that the pins may be again pushed into the outer ring of the movement to again afford a means of securing it in position.

These two rings will now require to be soft soldered to the lower ends of each hand. This may be done by turning out to right angles, in either direction, the two outer leaves of the lower scrolls. Each leaf should now be moistened with soldering fluid, and then held over the flame from a Bunsen burner or spirit lamp, with a small globule of soft solder placed upon the outer side of each leaf. When the solder has covered the allotted space, the ring should be anointed with fluid in two places, and held over the flame in contact with the freshly tinned leaves of the hand until the union between the two is complete. When the ring has

been soldered to the lower end of each hand, it will be time to permanently fix the two movements in position, previously determining which shall constitute the front or outer side of each hand. Assuming the reader to have provided the central bosses with the motion wheels, as advised, it will be necessary for these to be at the back of the hands (next to the glass dial plate) out of sight. This being settled, the front of each movement should be inserted in the ring with the centre and wind-up squares just flush with the outer edge of the containing ring, and as the barrel will be the heaviest part of the watch, this side of the movement should be located at the bottom of the hand. When each one has been satisfactorily adjusted it will be well to secure them firmly in position by means of two or three small brass pins pushed through holes drilled in each ring and into the plate of the movement. In all probability the existing pins in the latter will simply require to be withdrawn and then replaced through holes drilled in a suitable position in the containing rings before mentioned. It is needless to say the dials will require to be removed previous to the movements being fitted into the hands, and great care should be taken not to lose any of the motion wheels but to keep them distinct for each movement.

A couple of small brass discs, barely $\frac{1}{8}$ in. larger in diameter than the containing ring of each movement, must now be cut to the form of a true circle, and afterwards provided with a slight projecting ring or ledge of metal, which should be carefully soft soldered on to the surface of each disc in such a manner as to transform each one into a kind of lid or cover, capable of being fitted on to either side of the containing ring of the movement, which will thus render the works accessible from either side and provide for the necessities of winding, regulating, or setting the hands.

Those of my readers who are the happy possessors of a lathe and metal-turning appliances will doubtless form these covers out of a disc of stout metal, of which the centre portion can be thinned considerably in order to lighten it, and thus provide the desired projecting ledge.

At this stage of the proceedings we shall be ready to make the two weights by which the hands are driven. For each of these mark out on a piece of sheet brass, or copper—about the thickness of a stencil-plate—a plan of the metal casing the exact shape of Fig. 9, which is drawn full size, the metal being carefully cut to the form of the outline by means of a pair of scissors, after which the sides are bent up to right angles in order to form the finished tray or casing shown in Fig. 10. Having got a couple of these trays exactly alike, proceed to fit one of them to the hour hand in the manner about to be described:—Take the hour motion wheel belonging to the movement fitted to the hour hand of the clock, and proceed to punch a hole in the end of the projecting rim of one of the trays of just sufficient diameter to pass over the tube or pipe of the motion wheel, fixing it in position by means of a touch of soft solder. This done, the interior of the tray should be moistened with soldering fluid and then filled with some solder, which may be melted over a Bunsen or spirit flame in an old spoon, and then poured into the tray, after which it is carefully trimmed up by the use of an old file. It is necessary that these weights should be neatly and carefully made, otherwise, in turning within the box, they might happen to come in contact with the sides of the latter and thus stop the mechanism. When the weight is quite ready it may be slipped on to the cannon pinion, with the minute wheel in its ordinary place. After having ascertained that the weight is quite clear of the box on all sides when the lid is on, and the set square is turned by an ordinary watch-key, it will be necessary to just rivet the boss of the minute hand on to the end of the set square (the rod upon which the cannon pinion is fitted) in order to retain the weight in its place. All that remains to be done now is to carefully float sufficient soft solder on to the under-side of the hand near to the point, in order to make it balance quite correct at the three and nine o'clock. It will, however, be necessary to see that it points true at twelve, and also that it hangs perfectly even at six. Should it happen to be a trifle out at either of these hours, it will require a little more solder on the under-side of one or other of the outer scrolls, near the point of the hand—at the same time remembering that the amount of solder must be regulated so as not to throw it out of balance at the three or nine o'clock. In actual practice the correct weighting of the hands may be said to be the part which will call for the greatest amount of care and attention. As an additional aid Figs. 11, 12, 13, and 14 show the correct position of the weight when the hand is pointing at twelve, six, three, and nine o'clock.

When the hour hand has been correctly weighted in the manner above described, so that it will balance quite equal at the four quarters of the dial, the mechanism may be wound up and set in motion, after which our attention will be called to fitting a weight to the minute hand in a precisely similar manner.

Having previously cut out and turned up another small tray similar to the one just finished, punch a small hole at the end of the projecting arm, of sufficient size to take the tube of the hour-motion wheel, which is then soldered to it in the same manner as before, after which the inside of the tray is moistened with soldering fluid and then filled with melted lead, being finally trimmed up with a file to match the previous weight. It may be stated, as a guide, that about one pennyweight of lead was used for each of these weights by the writer. The weight being ready for attaching to the movement, first remove the minute wheel, as this will not be required, and then pinch the tube of the wheel just soldered to the weight sufficient to allow of its being tightly pushed on to the cannon pinion, after which the boss of the minute hand is put on to the end of the set square, and then fixed in its place by means of a few taps with a light hammer. The weight should now be revolved in the case a few times, in order that it may be seen to be perfectly free at every part. As the weighting of the minute hand with solder requires to be carried out in a precisely similar manner in every respect to what has already been said with regard to the hour hand, it will be needless to repeat the process again. Suffice it to say that, as this hand is of a greater length than the other, it will not require so much weighting to make it balance true, and, when properly balanced every way, it can be wound up and set going in unison with the other.

It will be found that, as soon as the hand has been started, the slightest movement of the small weight contained within the case will affect the hand, and cause it to move forward. If it should happen to move in short jerks, it is a certain sign that the weighting is at fault somewhere, and this should be remedied by cutting up thin strips of solder and bending them double, in order that they may be made to clip the hand at various parts, until it can be ascertained where they are required.

The watch is very easily set to time by removing the front cover and then turning the centre set square until it balances the hand at the desired hour; and as no works or wheels or wind-up holes are visible from the outside, it renders the clock truly "mysterious," and a source of great wonderment to most people. The only drawback to a clock of this description—if it can be called a drawback—is the necessity for winding it up every day. If the two movements have been carefully regulated in unison, the clock will be found to keep accurate time, as the two weights do not affect the going in the least, because every trifling decrease of the weight contained in the box caused by its moving onward will be found to add to the weight of the point of the hand, and thus to make it move forward.

For the purpose of trying the hands until the dial is ready, it will answer very well if they are pivoted upon a small French wire-nail, or a piece of thin, round umbrella wire driven into the wall.

Now that the clock is going, it will be advisable to turn our attention to the preparation of the glass dial-plate. For this we shall require a sheet of patent plate, of sufficient size from which to cut an 18 in. circle, which must be provided with an $\frac{1}{8}$ in. hole in the centre, and a couple more about 9 in. apart in the outer edge, to which to attach the silken cords for suspending the dial. Some of my readers may consider the cutting of a circular plate of glass of the size to be a matter beyond the capabilities of an amateur, but in actual practice this is not the case, provided that the following mode of procedure is adopted. In the first place, mark out a circle of the required diameter on a piece of stout millboard of sufficient size, and then cut this to the exact form with great care. The sheet of glass is now laid on a perfectly flat surface, with the millboard disc placed in a suitable position upon it, after which an ordinary sixpenny wheel glass-cutter is rapidly run round the outer edge of the card, care being taken not to press on the wheel sufficiently heavy to cause the glass to fly. When the circle has been cut—and not merely scratched—on the surface of the glass, the four corners of the plate are then cut across diagonally in the manner shown in Fig. 15, which will thus enable the operator to break away all the waste glass surrounding the cut circle. When the glass has been properly cracked by the action of the glass-cutter, it is possible to see the crack by turning the glass over on the reverse side. The diagonal portion can be readily broken off by holding the plate with the crack level with the edge of the work-board or table, and applying a uniform downward pressure upon the reverse side to the cut, any very obstinate portions being afterwards nibbled off by means of the slots in the glass-cutter. As soon as the plate has been cut, the edge will require to be ground smooth with very fine sand, after which the three holes are drilled in the positions before indicated by means of an ordinary glass-drill, heavily weighted, and a little emery powder and oil of turpentine as a lubricant.

At this stage of the proceedings, we shall be ready for the spindle upon which the hands are to turn. This can be formed

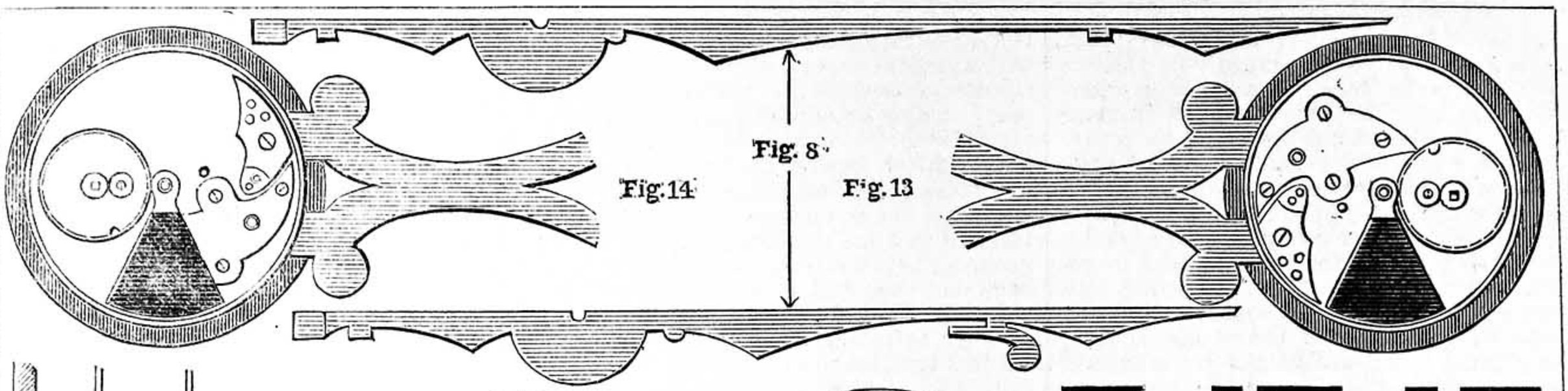


Fig. 14 Fig. 8 Fig. 13

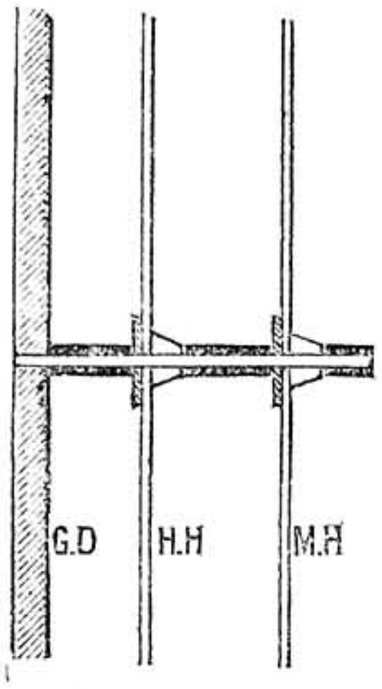


Fig. 16

Fig. 20

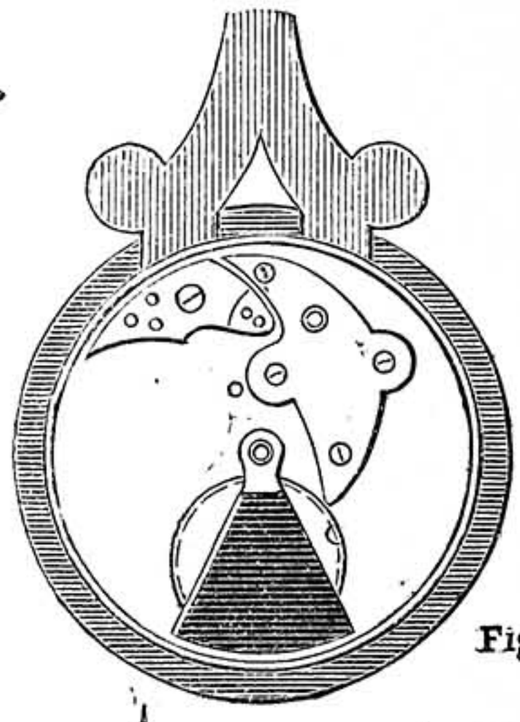


Fig. 11

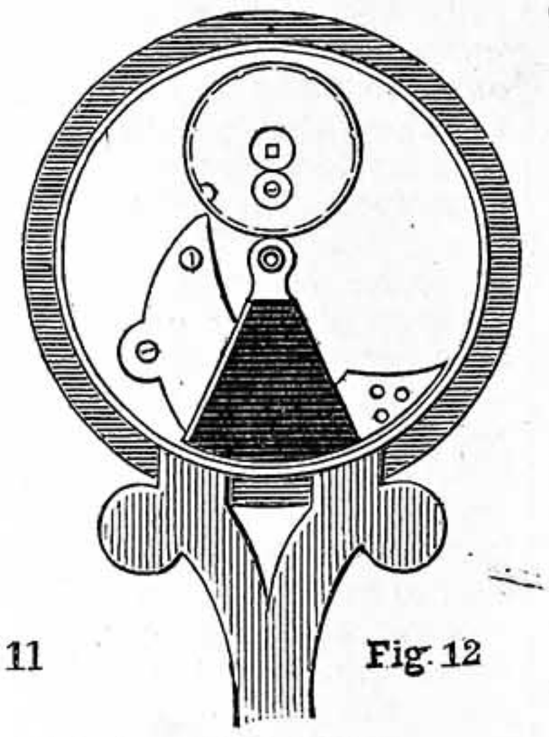


Fig. 12

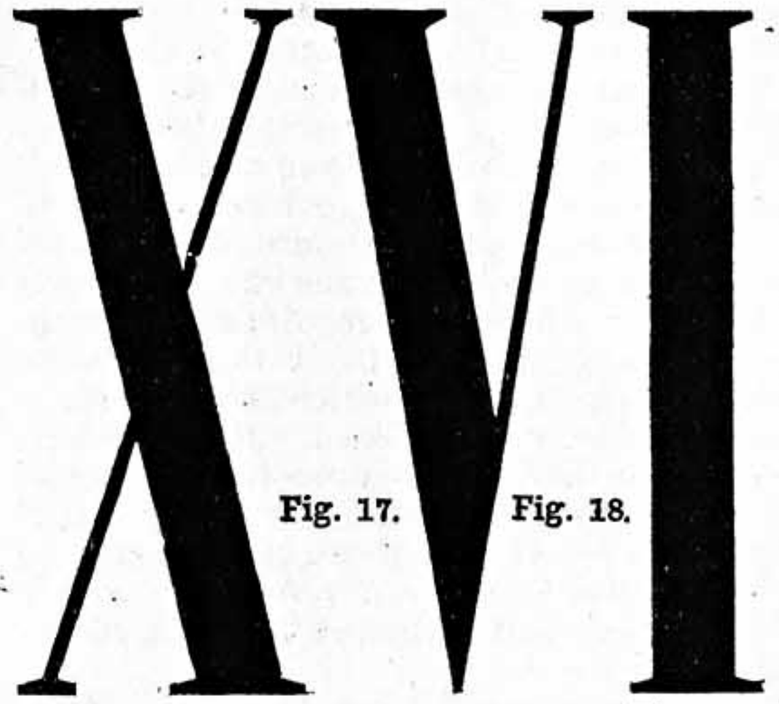


Fig. 17. Fig. 18.

Fig. 19.

Fig. 2.

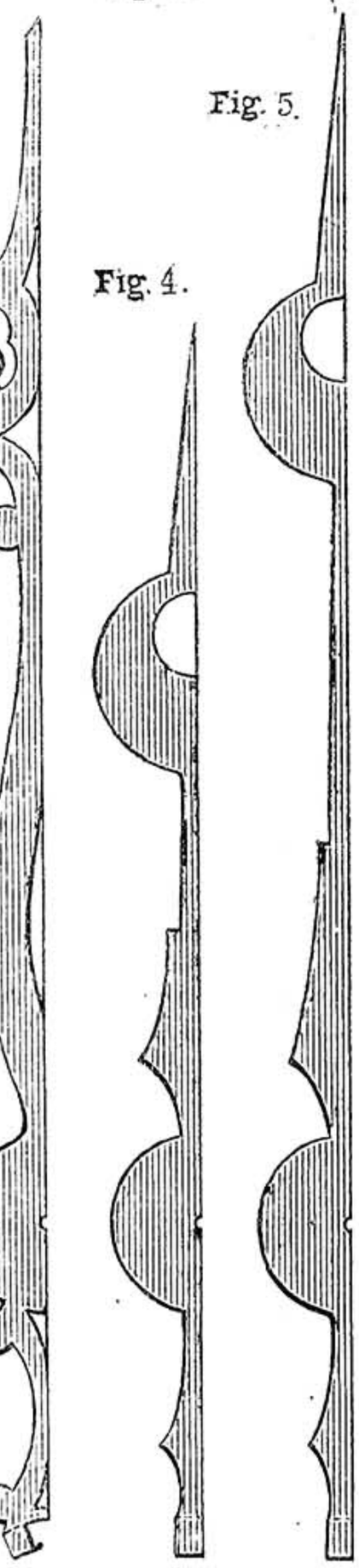
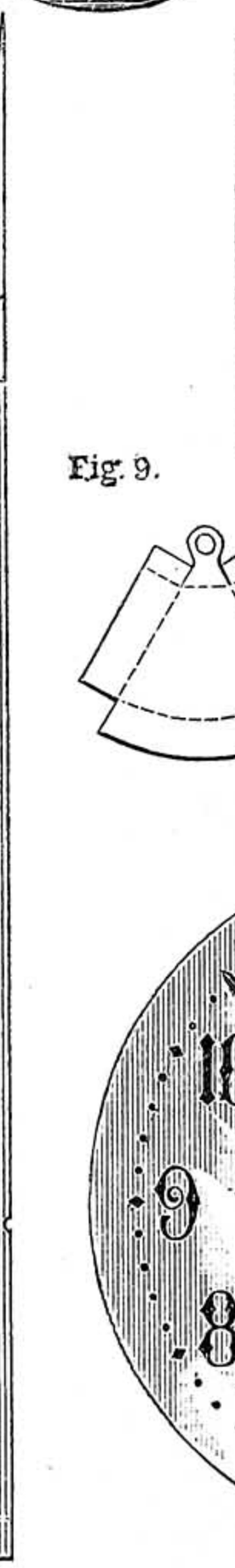


Fig. 5.



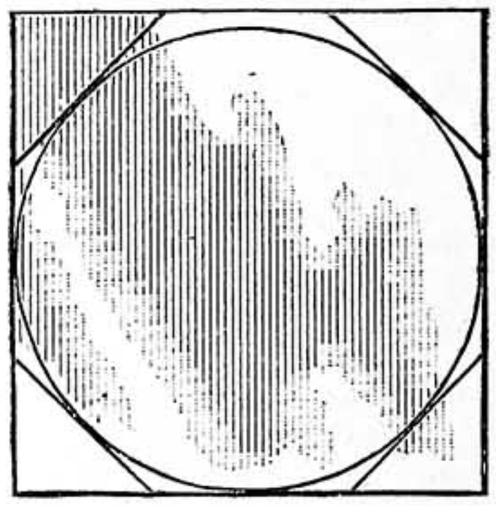


Fig. 15.

Fig. 6.

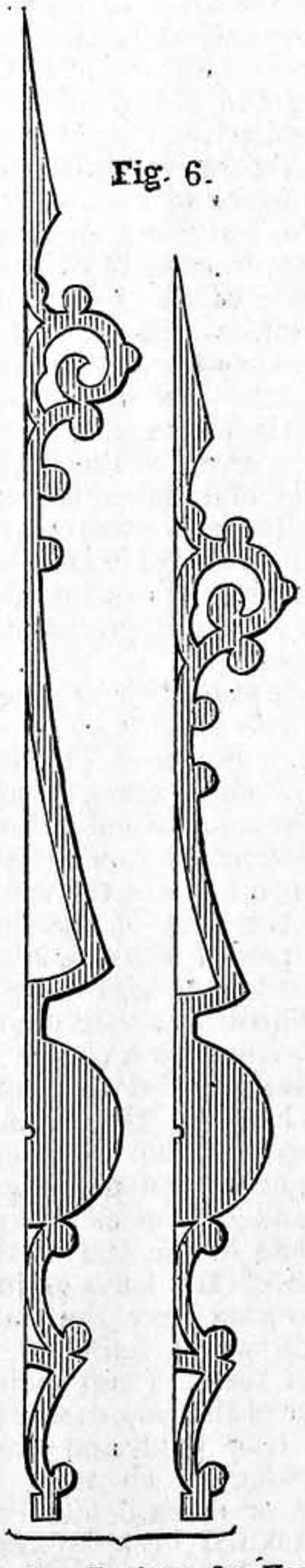


Fig. 7.

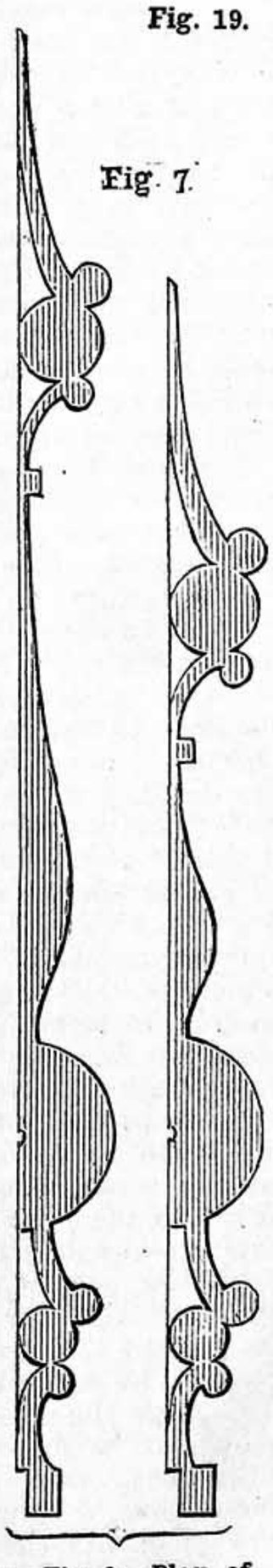


Fig. 3

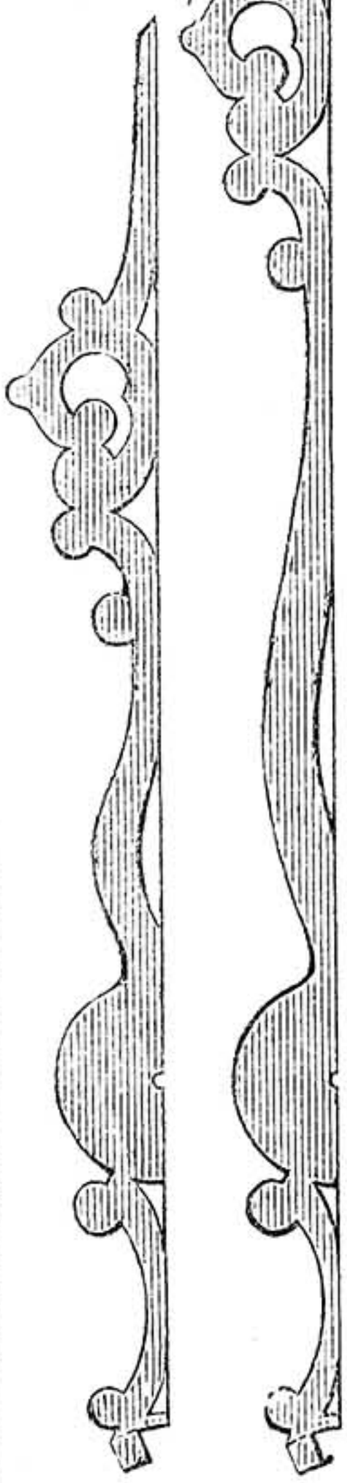


Fig. 4.

Fig. 9.

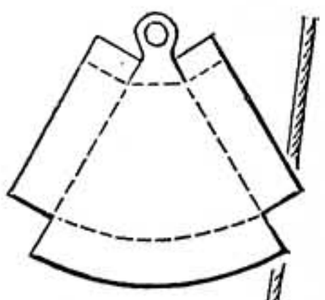


Fig. 10.

Fig. 1.

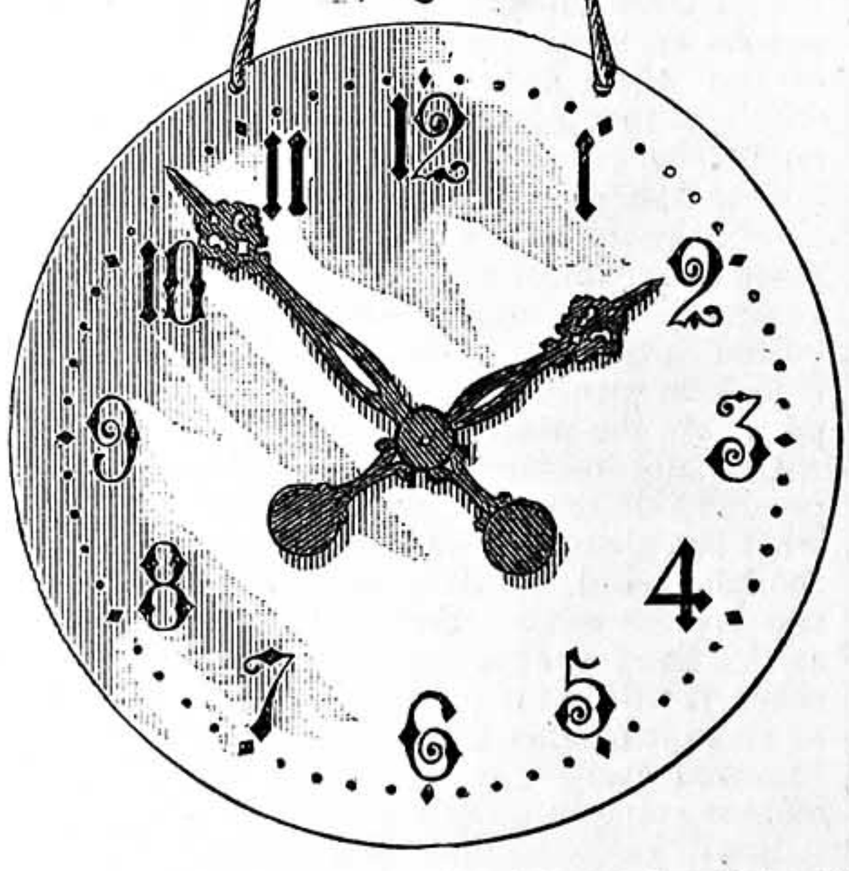


Fig. 1.—Mysterious Clock. Figs. 2, 3, 4, and 5.—Half-size Plans of Hands. Figs. 6, 7, and 8.—Alternative Designs for Hands. Fig. 9.—Plan of Casing for Weight. Fig. 10.—Weight complete. Figs. 11, 12, 13, and 14.—Position of the Weight at the four Quarters of the Dial. Fig. 15.—Plan of Glass Disc, showing Mode of cutting Circle. Fig. 16.—Section of Glass Dial, showing Spindle upon which Hands turn. Figs. 17, 18, and 19.—Full-size Roman Figures for Dial. Fig. 20.—Dots and Stars for denoting Minutes.

of an inch-length of straight steel or brass wire, upon which the hands will rotate easily. This should be fitted with three short lengths of brass tube of sufficient diameter to fit tightly on to the rod, and thus keep the hands apart, at the same time allowing them plenty of freedom. When the spindle is ready, it should be cemented into the central hole of the glass plate by means of a mixture composed of Le Page's fish-glue and plaster of Paris, made into a thick paste. Any other cement can, however, be used with equal success—as, for instance, Prout's elastic glue. Care should be taken to see that the hands run true before the cement has had time to set. Fig. 16, which is a section of the glass plate and spindle, will show clearly the disposition of the various parts.

For a large-size dial like the present, a disc of stout plate-glass would be far more preferable to one made of patent plate; but if the reader intends employing a disc of this description, he will find it impossible to cut it to the required shape and grind the edges without the aid of special appliances. He will, therefore, find it necessary to obtain it finished ready for use from some plate-glass warehouse. It may not be out of place to mention that Messrs. Hard and Austin, of Great Sutton Street, London, E.C., looking-glass manufacturers and silverers, will supply a disc of the dimensions required, with three holes drilled as described, for a few shillings.

The dial, when ready, can either be painted by a professional dial-painter—for instance, Mr. Pulman, of St. John's Square, Clerkenwell, who would paint a dial of the size with Roman figures for about 1s. 6d.—or the reader can cut the figures or numerals out of white, gilt, or black paper, and then paste them on to the glass by means of shoemakers' paste, Le Page's fish-glue, or similar suitable cement, small dots being used for the minutes and stars just above the numerals, as will be seen by reference to Fig. 1. The figures shown in the above-named cut can be enlarged, if desired, and cut out of paper as above directed. Three full-size examples of Roman figures suitable for this dial are shown in Figs. 17, 18, and 19. By cutting twenty duplicates of I, four of V, and four of X, the reader will thus have a full-size set of figures ready for pasting on to the glass dial-plate. He will also require forty-eight dots and twelve diamonds or stars the same size as Fig. 20. A touch of whiting mixed with a little soap, and applied to the under-side of the glass plate, will indicate the exact position to be occupied by the figures. Nothing less than two-inch figures should be used, as they would otherwise look insignificant by the side of the hands. The white-enamelled copper letters made by Messrs. Willing and Co. would, of course, look the best for the dial, but unfortunately the price is prohibitive to a great many, a complete set of two-inch Roman figures, with dots and stars, costing the not small sum of 13s. 6d. to make.

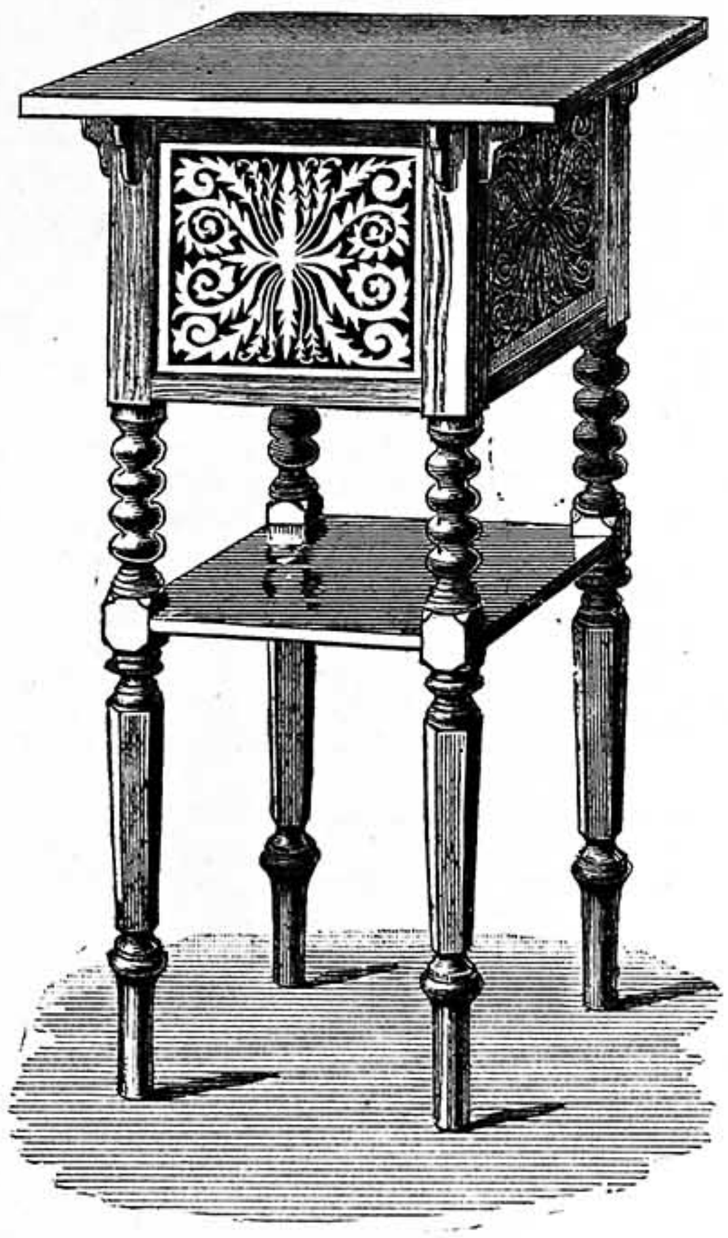


Fig. 1.—Work-Table complete.

A TINY WORK-TABLE.

BY E. BONNEY STEYNE.

THE little table here illustrated is made from a set of turned legs, sold by Messrs. Duffy & Co., at a cost of 3½d. each in deal, 9½d. in pitch-pine for 1¼ in. size, and a trifle more for 1½ in., 1¾ in., and 2 in. respectively. The framework is of the simplest. A small cupboard is formed immediately under the top, enclosed by panels of fretwork. The quarter design given in full, if repeated to its intended size, will serve to fill either the front one only or all the sides, as the worker may wish. A shelf mid-way down the table assists in keeping the whole rigid, and increases the use of the little table. A deep drawer for work may replace the cupboard, or a drawer with a great bag pocket of fluted stuff, so frequent in old tables, may be added below the shelf.

The little table has no pretension to artistic beauty, but as an oddment, to be made in spare time at a small cost, may find favour in the eyes of our readers. The finish, whether ebony, enamel, or stained or polished, is a matter for individual taste to decide.

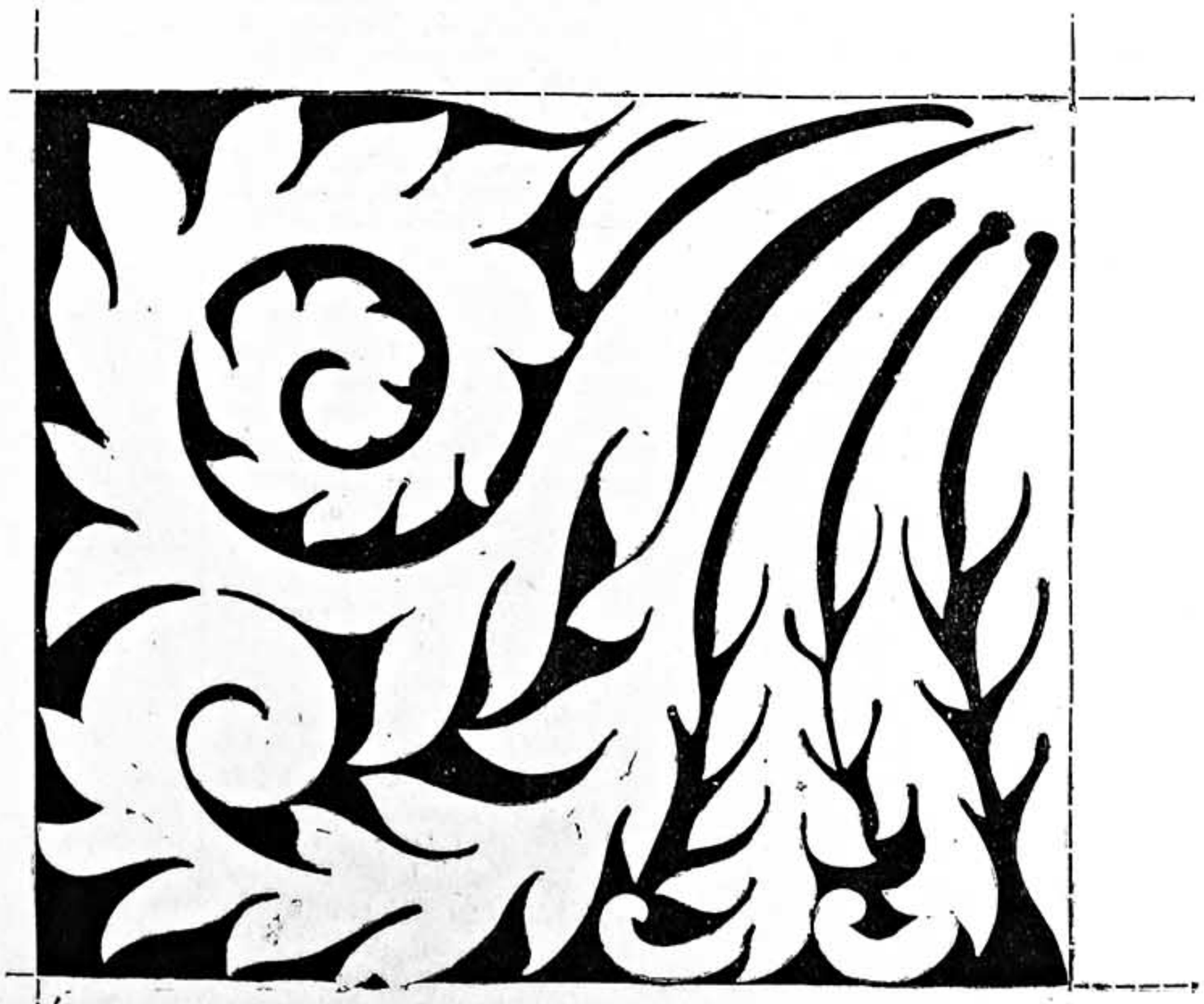


Fig. 2.—Quarter Part of Panel in Fretwork (full size).

LENS SHUTTER ADAPTERS.

BY H. J. L. J. MASSÉ.

ADAPTERS—COST OF—SUBSTITUTE FOR—MATERIAL OF AND MODE OF FIXING—ADAPTING SHUTTER.

THE want of a ready means of adapting to my camera the three different lenses in my possession, without the delay in changing the front bodily each time, and without the expense of buying adapters (such as are sold for the purpose), led me during last summer to devise the following expedient.

In addition to the single landscape lens supplied by the makers of my camera, I occasionally use a wide angle and a rapid rectilinear lens. As the screw-threads on these where fitted on their flanges were all different, and as the flanges were all of different sizes, I found on inquiry that I should require an expensive universal lens-holder, or two separate adapters, one to adapt the wide angle and one to adapt the rapid rectilinear lens to the flange of the single lens on the camera. The estimated cost for the two adapters was about 6s., and, as I wished to economise, I took the flanges off the wide angle and the rapid rectilinear lenses, and screwed each of them on to a stout piece of leather, like that used for soling boots, which had been previously soaked a little, well hammered out, and allowed to dry. Then I chucked the flanges in the lathe, turning the leather in such a way that by removing a disc from the centre a washer of leather, bevelled on its inner edge, remained on each flange. These washers were then turned as to their outer edges, so as to fit exactly into the flange of the single lens.

Each piece of leather was cemented, as well as screwed, to its respective flange, for the sake of keeping all light out, and was well blackened with ink. Each flange is kept securely in its place on the camera front by two small brass buttons screwed on to the camera front.

I was led to adopt leather as being unbreakable, rigid, and not likely to warp. The weight of the two pieces of leather on the two flanges is practically *nil*, and the expedient has, so far, answered its purpose perfectly.

So far for the lenses. I next approached the subject of shutters. The one I use is a roller-blind shutter, a form to which I am peculiarly devoted, as it

gives the right exposure to the foreground. I had fitted it originally to the single landscape lens, and want of room prevented me from buying another for the rapid rectilinear lens; but, finding that the hoods of the two lenses in question differed so slightly in size, I slipped an indiarubber band on to the hood of the rapid rectilinear, and the cork back of the shutter fits on like a glove. By turning a washer of boxwood, or other hard wood, to fit the hood of the wide angle lens, the same shutter would do for that also; but with this lens I have, up to the present, required cap exposures only, as I have only used it for photographing interiors.

CIRCULAR OR CURVED PANELLING.

BY "CHOPSTICK."

INTRODUCTION—CORRECT MEASUREMENT—SETTING OUT RAILS AND BLOCKS—GLUING UP AND CLEANING OFF—INTERNAL CURVES—CONCLUSION.

I DO not intend this paper for the experienced joiner who is employed in a large establishment, where machinery for every purpose is at hand, and who would smile at the thought of doing a simple job by such primitive means, but rather for the small shop in the country where such jobs are few and far between, and where machinery is conspicuous by its absence. In such places it sometimes happens that a new counter front has to be made, and, instead of the common square corner to the panel work, it has to be rounded off, which, to say the least, looks decidedly better. When I was young and in the country ("about five miles from nowhere," we used to say), we had a bar in a public-house to fit up in this way, and I was ordered to make a piece of panelling for the front and a piece for the end, and fill in round the circle with narrow pieces of match-boarding. This did not suit my fancy at all, so I set my wits to work and made it in the way I am about to describe. The first thing to do is to take the

Correct Measurement.—To do this, you must draw on the shop floor a plan of the whole affair, with a circle at the corner of the sweep you intend having; then measure carefully round the outside of the marks. If this is not done correctly, when you come to fix the panelling you may have to cut away the outside stiles, and that would spoil the look of the whole job.

Setting out Rails and Blocks.—This will be done exactly as though it were a piece of straight panelling, but, if possible, arrange it so that a muntin will come at the extreme end of each straight part, as shown in Fig. 1; and if the circle is a large one, so as to require a muntin in it, it must come in the centre as shown, but it is much better for one panel only to bend round the curve. When the rails are set out and mortised, cut away between the two mortises which come close to the curve, so as to leave only a small piece of the thickness of an eighth of an inch. This piece is shown at D (Figs. 1 and 3). Then make a block as A (Figs. 1 and 4). The outside must be cut to the same curve which the finished panelling is to have, and at the points where the quarter circle ends cut a notch exactly the same depth as you cut out of the rails; these notches must be at right angles with one another, as shown by dotted lines in Fig. 4 (I omitted to say that the block should not be so deep as the rail by half an inch; thus, if the rail is 7 in., the block must be 6½ in.). A rabbet must now be cut round the circle at the top edge of block, three-eighths of an inch on, and the same depth, and a piece of wood an inch wide and three-eighths of an inch thick bent round and glued and nailed there. Now you place the block on the bench, and fix the front or longest part of the rail to one of the notches which are cut in the block, with a screw as shown in Fig. 1, then carefully bend the rail round, and fix the other side the same. If it comes correct—and it should do if you have followed my instructions closely—you can now unscrew and glue the block, then fix again in the same way with screws, and put on one side till dry.

The next part to proceed with is the gluing up, but before doing this cut off the inside of the groove for the panels on the

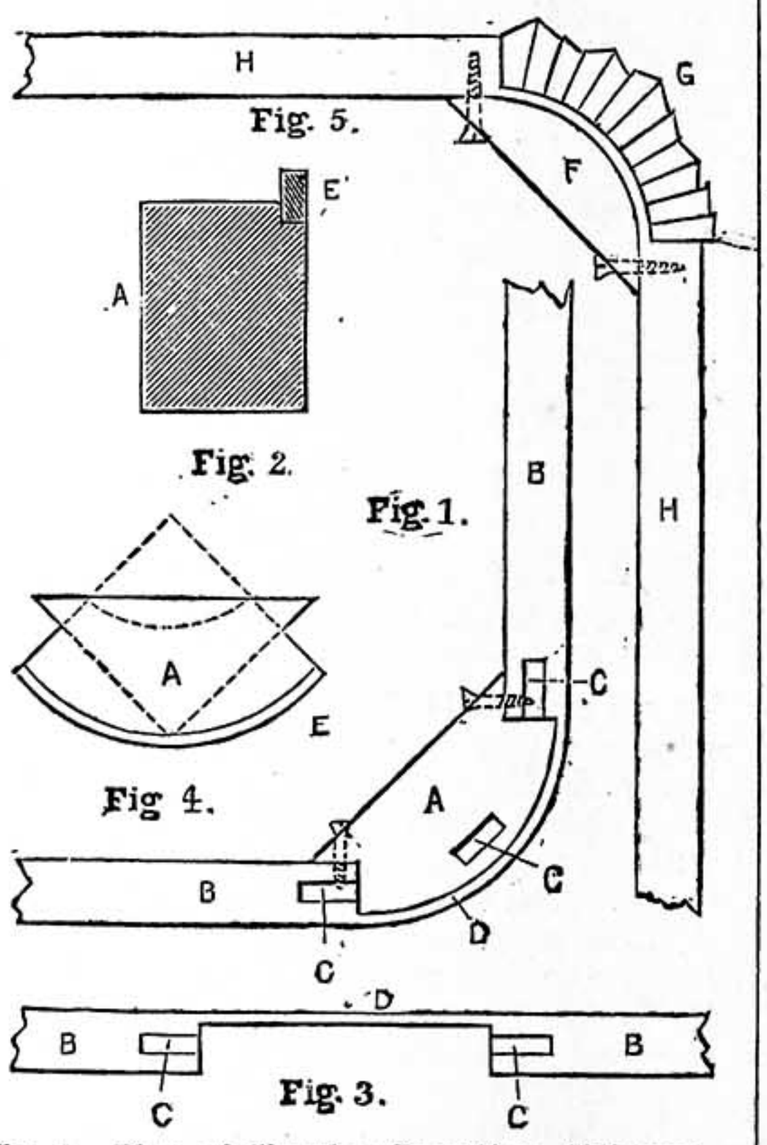


Fig. 5.

Fig. 2.

Fig. 1.

Fig 4.

Fig. 3.

Fig. 1.—Plan of Circular Panelling, External—A, Block; B, Bottom Rail; C, Mortises; D, Part of Bottom Rail not cut away. Fig. 2.—Section of Block A—E, Thin Piece bent round to fill up to Panel. Fig. 3.—Bottom Rail cut but not bent. Fig. 4.—Plan of Block A. Fig. 5.—Plan of Circular Panelling, Internal—F, Temporary Block for Template; G, Blocks glued on to make up Rail after being bent; H, Bottom Rail.

two muntins into which the circular panel is to fit, so that this will go into a rabbet instead of a groove, then glue and wedge up in the usual way. This being done, you can proceed to put in the circular panel, and you will see the reason why the muntins are rebated instead of grooved, as, if they were done the latter way, it would be an impossibility to get the panel in. You will also see the meaning of the raised piece (E, Fig. 2) on the block, which is to make up the proper thickness outside of the panel. The panel can now be nailed into the rabbets from the back, as it will be found to bend round with a little persuasion, and it is as well to fix it still more firmly with thin curved pieces cut to fit it inside, and nailed to the blocks. The whole can now be cleaned off, remembering to take a little extra care round the curve; and, the moulding being put in, the job is finished, and if properly done cannot fail to be satisfactory. If you thought proper, the block could be cut away as shown in dotted line in Fig. 4, but it would take away part of its strength, therefore I do not recommend it.

The above, you will of course understand, refers to panelling with the circle outside. I will now show you how to proceed when the circle is inside, as shown in Fig. 5. This is done in the same way as the other as far as setting out, etc., is concerned, and the rails must be cut out in the same way, only the part left on to form veneer will have to bend the opposite way. We must also make a block, as before, but it will require no notches, only it will want carrying on for an inch or two in a straight line beyond the quarter-circle, so that the screws for fixing it can be screwed into the solid rail beyond the veneer. The block in this case will only be required temporarily until the glue has set, as it will be on the face side of the panelling. Having got all ready, screw the block in position as shown at F (Fig. 5), then fit blocks all round as shown at G, and glue them so as to fill up tightly and firmly to the proper thickness. This, after the glue is set, will effectually hold the rails to the proper curves; and as all the rest of the work will be the same as I have explained above, with the exception that the panel and mould have to be bent the opposite way, I need not go over it all again, as you will be able to manage one as well as the other.

In conclusion, I may say that the latter way of filling up the part cut away is nothing new, as it is the way adopted in making good staircases, with well-holes, to fill up the string-board after bending, and is much better for this purpose, as well as for the panelling, than cutting the curve out of the solid, as it shows the grain of the wood all round, which the latter would not, as well as being stronger.

If there are any details which I have not explained clear enough, I will do so, if called upon, in the "Sloop" columns.

SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

FIXING SHELVES.

THESE papers would be very imperfect if some attention were not bestowed on fixing of a simple character. To fix a shelf is regarded by the ladies as a proof of mechanical ability and of helpfulness.

We will suppose a recess and a board of ample length destined to become a shelf. The following plan will lead to success:—First take the angle of one end of the recess. This can be done with a two-foot rule, opening it to fit the angle, and marking the same on the board. Secondly, measure the length of the recess, and mark the same on the back edge of the board. Thirdly, take the angle of the other corner of the recess as the first was done, and mark in like manner on the board, as before. If the board is now cut to the lines, it will fit. To avoid any disappointment which might arise from imperfect plastering, rendering the angle uncertain, it would be better to decide the height, and fix a ledge or bearer of wood to the wall. These bearers of 1 in. wood, about 3 in. wide, and length according to the width of the shelf, are usually nailed to the wall—if it is a wall, and not a lath-and-plaster partition. There is some risk of failure, which cannot be avoided. The nail may come in contact with a very hard brick, and refuse to be driven. In that case, either drill or chisel with a small

cold chisel a hole in the wall, cutting it deep enough to hold—say, at least 2 in. Then cut a piece of deal about the right size, but taking care to chisel it somewhat in winding. The hole may be slightly undercut, and the plug driven in with a hammer. When driven sufficiently, no more blows must be administered, for when the plug will go no further, additional blows only tend to loosen it. Any surplus block must be cut off with a saw, taking great care to avoid spoiling the wall surface beyond that which the bearer covers. In most instances, however, it will be found that a good nail, straight and stout, will go into most brickwork that has been plastered over; but avoid slender nails, and bore holes in the bearers for the nails, for it is essential that the nail should hold more tightly in the brickwork than in the wood. But it may be that our wall (in appearance) is but a lath-and-plaster partition. Then the position of the upright timbers must be ascertained, and the bearer screwed or nailed to them. By all means use screws if possible. To find out where the timbers are, tap with the knuckles or very gently with a hammer. The difference of feeling and of the noise will soon indicate the position. Do not strike hard, or a rattling noise will remind you that you are knocking off the "key" or overhanging plaster from the inner surface of the laths. If you do much in that way, the plaster will soon be loose in front, so be gentle, and use screws instead of nails. When one nail or screw is inserted in one of the bearers, test with a spirit-level. When satisfactory, put in the rest of the nails or screws; then put the shelf in, if properly cut. It will almost support itself. If loose, get a helper to hold it at the free end, or prop it up; test with spirit-level, and mark for the other bearer, if necessary. Remove the shelf, but if it fits rather tightly, avoid doing so, as it will most likely damage the wall. If the ledges have been cut wide enough, they can be fixed without the removal of the shelf.

Only one other difficulty may occur—the partition may be covered with patent plastering, in which case it will be difficult to tell where the timbers are. But there is this compensation: that screws will hold fairly well in the plaster itself, independent of the timbers.

Building up and Putting Work Together.

Amateur work depends very much upon the care with which the various parts are united. Structures which professionals make in few parts, of considerable size, the amateur must construct in smaller parts, and unite these together afterwards. We will look at a few of the methods adopted for this purpose.

There is the plinth and cornice mode of uniting parts, capable of being used even more frequently. In this a pair of frames are made, usually dovetailed together, though the back rail is often grooved to the end pieces and blocked. These frames, forming the vertical surfaces in the finished work, have affixed to the edge of each a piece of wood, moulded, or suitably finished. The inner angles of these frames, not being visible, are secured more firmly by means of "blocks." These are merely pieces of wood, prepared in any length to the proper angle. In this case, two adjacent surfaces must be at right angles. In order to distinguish these prepared sides of the wood, the opposite angle is planed off, and the strip is cut into suitable lengths. These "blocks" may be used in any interior angle not exposed to sight, and are most useful and effective.

Dowels, used in this union of parts, serve to prevent sliding motion, and to secure the proper position of each portion of the work. Ordinary wood screws are frequently used in conjunction with dowels. Table tops are frequently fixed with screws inserted obliquely through the inner sides of the frames; such fixture ought not to be permitted where any probability of shrinkage exists. A better plan is to make a mortise in the frame and screw a block, which has a projecting tenon, to the under-side of the table top. It is quite useless and unwise to ignore the fact that wood will shrink, even after considerable time has elapsed since its being made into furniture, unless the material has been kept for a long time in a dry place. No expansion, through damp, need be feared in furniture; but outside work, such as doors and sashes, if made of well-seasoned wood, will often need "easing" in damp weather. This shows that panels for exposed situations should not be too wide, and that ledged or clamped work is unsuitable.

The use of mouldings to conceal the junction of parts has much to recommend it to the amateur. These mouldings should be fixed to one of the parts, and preferably to the part most exposed to sight, the part fitting loosely into the moulding not being so good in appearance.

Bolts, screws, thumb-screws, dining-table fasteners, studs and plates, hinges with loose pins, and pivots in lieu of hinges, are all means, provided by the ironmonger, by which parts of a structure may be connected to each other, but they ought not to be depended upon without means of adjustment made by the worker; they are, in most cases, fixtures capable of spoiling the work by careless adjustment.

I know that this will be regarded as a reason for planning out the whole work carefully before attempting construction. Be it so. No better lesson can ever be given than one which most convincingly sets forth the value of careful planning as a precursor of successful construction.

HOW TO MAKE A RESONANCE BOX.

BY AN OLD TEACHER.

Although the zither is universally admitted to be one of the sweetest of all stringed instruments, it is also one of the least noisy—indeed, its tones are so "sweetly subdued" that it becomes imperative to augment them artificially. For this purpose we make use of a simple but very effective contrivance, known as the resonance box. This appliance consists of a shallow closed box, either supported upon legs—when, to all intents and purposes, it becomes a table—or upon short claws or knobs, as shown in the diagram, when it is placed on another table when in use. As its only use is to augment the tone and volume of the instrument, neither form has any advantage over the other; it is simply a matter of taste. For those who have ample room the table form has the preference, as, except on the top, it admits of any amount of ornamentation or enrichment, and thus forms an elegant addition to a drawing-room; while those who are cramped for space naturally prefer the more portable form, which may be placed aside when not in actual use. There is not much to describe about this article, and the veriest tyro will have no difficulty in making a thoroughly serviceable one. The sizes given in the illustration need not be taken as hard and fast, as, so long as the box or table is longer and wider than the zither, and at least twice its depth, the exact size is immaterial. The table shown in elevation in Fig. 2 represents one made for a pupil some years ago by the writer, and may be taken as a fair type.

The materials used were as follows:—For the sides and ends, ¾ in. pine; for the top and bottom, ½ in.; the legs were already on hand.

For the top a nice piece of wood must be used, free from knots or shakes, while that

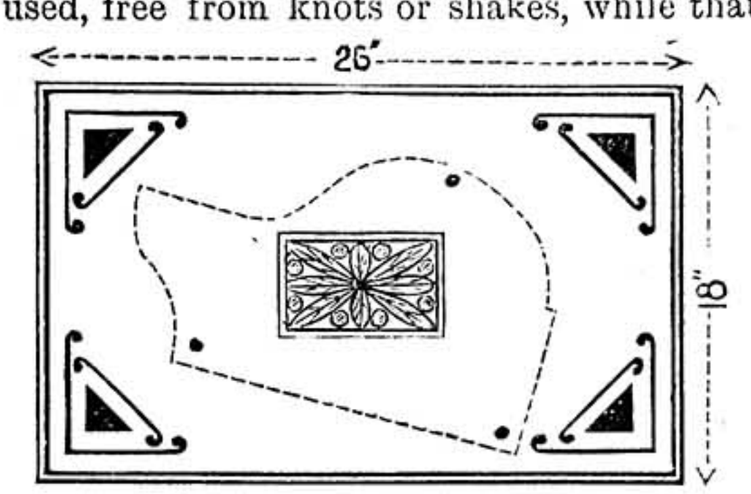


Fig. 1.

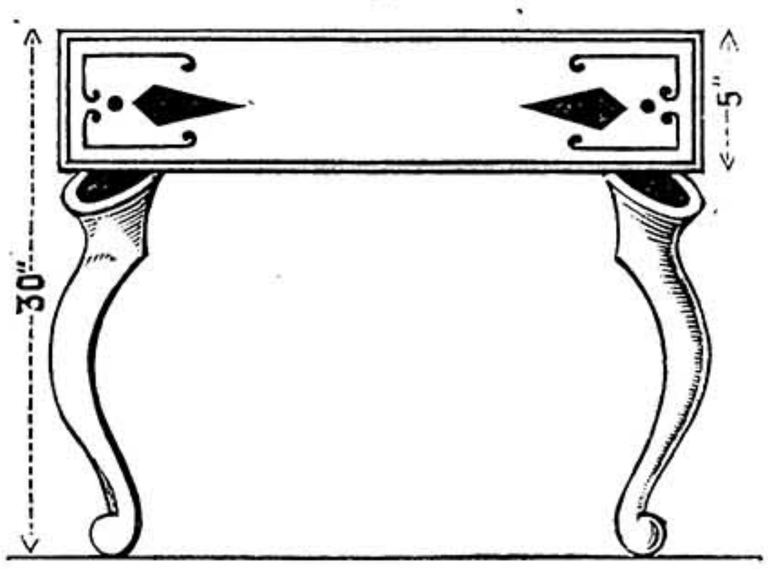


Fig. 2.

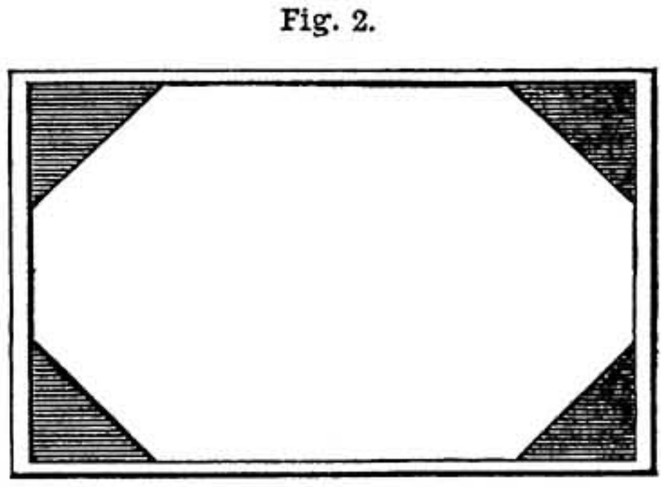


Fig. 3.

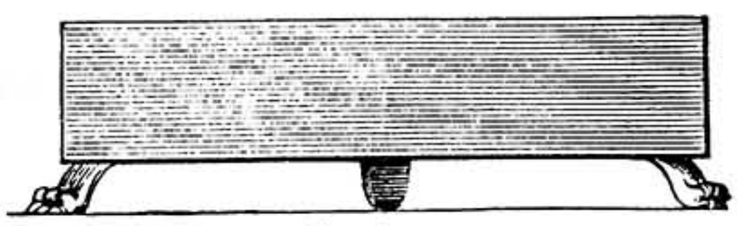
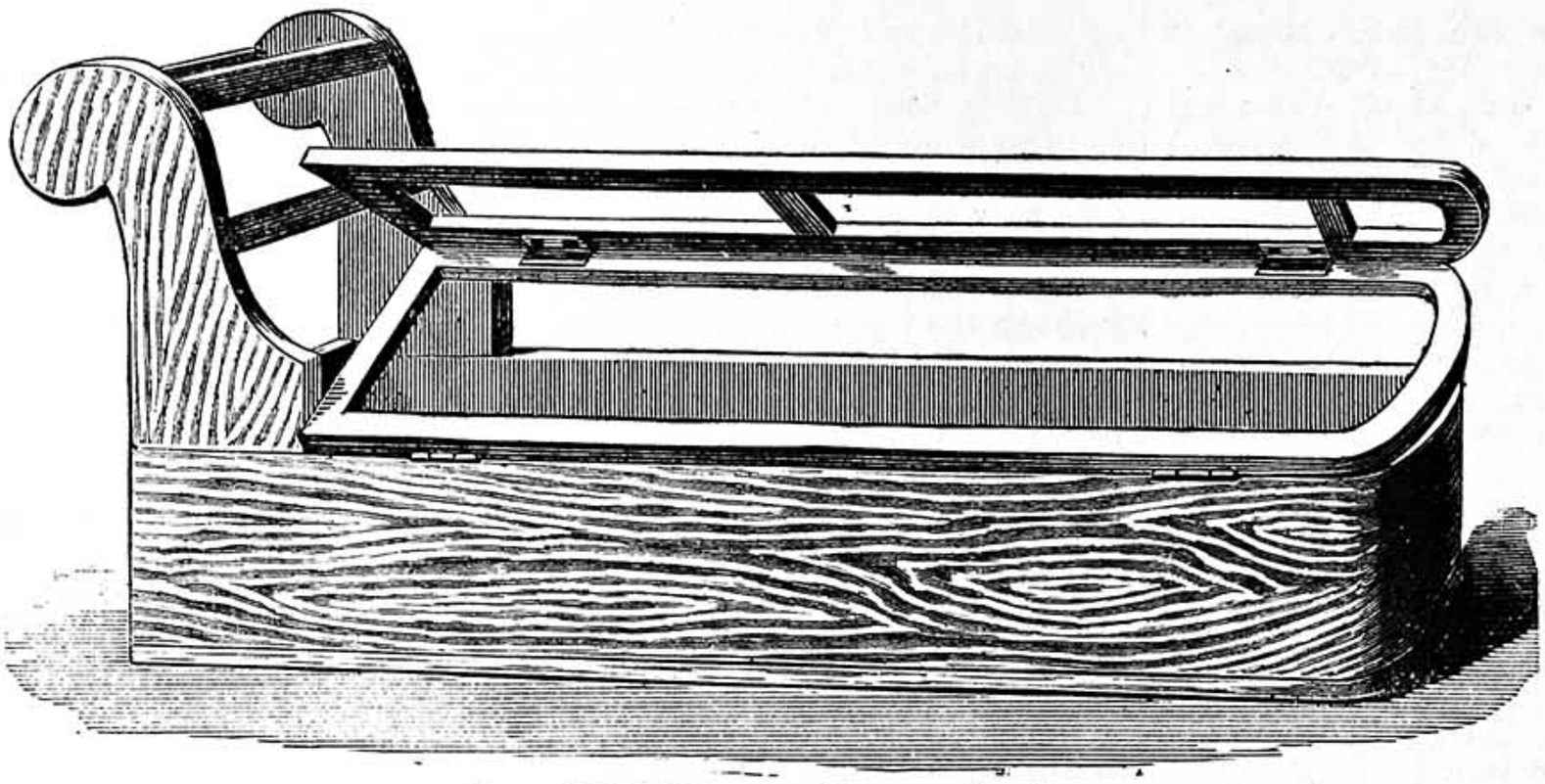


Fig. 4.

Fig. 1.—Plan. Fig. 2.—Elevation. Fig. 3.—Inside of Box, showing Method of fixing Legs. Fig. 4.—Alternative Form for use on Table.

used for the bottom should approximate to it as nearly as possible. If there is any best, let it come at the top. In the centre of the latter a sound-hole must be cut of any approximate shape or size, but this may be filled in with a fretwork panel. Instead of one large sound-hole, two, three, or four smaller ones may be made, but in this case care must be taken to keep them clear of the places where the "legs" of the zither will come. The dotted outline on Fig. 1 shows the position of the instrument on the table when in use, and the "legs" are shown as black dots. Pine is the only wood suitable for the top and bottom, but any kind of *hard* wood may be used for the sides or ends. Fig. 4 shows the alternative form of the

resonance box, but the construction is precisely the same, as the short legs should be continued up to the top, as in the case of the others (see Fig. 3). Probably the most logical mode of finishing would be to polish, but the one which formed the prototype for this article was simply ebonised and picked out with gold, the fretwork panel being gilded, as were the lines shown in the cut. The precise amount of ornamentation may safely be left to individual taste, but do not overload it, as, after all, such a table should serve as a foil for the instrument placed upon it, and may, therefore, be kept as severely and classically plain as you please. It ought to be noted that when made for use upon another table, three legs are preferable to four, as stability is thereby ensured, which is a matter of considerable importance. It might also be worth while to combine a music desk or stand, which no one would be at a loss to know how to do. As a rough guide as to height (when made as a table), you may remember that, when seated, the zither should be on a level with your *elbow*.



Reversible Lid for Box-Ottoman Couches.

A REVERSIBLE LID FOR BOX-OTTOMAN COUCHES.

BY JAMES SCOTT.

Among my many trade acquaintances, I number one who is possessed of much inventive talent of a simple nature. One of his "ideas" is embodied in the article illustrated herewith. Upon noticing the paper "How to make an Ottoman Couch" (page 728, No. 97, Vol. II.), it occurred to me that many readers who might have adopted H. Hinge's practical and plain instructions, or had intentions of making such a couch in the future, would prefer to fit it with a lid of the peculiarly useful kind which is shown in the annexed sketch.

Its object and utility must be apparent to all workmen who will examine the drawing. There are two framings: the top one being covered in a similar manner to that lucidly described by H. Hinge in the above-mentioned paper; and the under one being always uncovered, precisely as it is here shown. The lower one is hinged to the couch on one side, it matters not on which, while the upper one is similarly attached to the upper surface of the lower one, on the opposite side. A handle is fitted on the front of the top frame, and another to the back of the lower frame. Whether the article be placed in an apartment with the scroll on the left-hand side, or on the right-hand side, the lid can be opened; in one case by raising only the upper framing, and in the other instance by raising both together.

Only an extra framing, therefore, is needed, in addition to the various parts spoken of by H. Hinge, in order to convert the couch into a reversible article. I do not know of a more *useful* couch than this "box-ottoman," as it is dubbed.

It may be well for me to add that my sketch is taken from a sheet of drawings of this particular couch, which I drew and printed for its maker, who is also the inventor of its lid, a year or so ago; and is not traced, as might at first appear, from H. Hinge's drawing. A note to the inventor and manufacturer, Mr. J. Trevallion, 14, Henson Street, Old Street, E.C., will elicit any further particulars relative to this article; and a request for a sheet of illustrations with prices indicated thereon, for anyone who may wish for such, will meet with courtesy.

I need only add that if any amateur who tries his hand at making this reversible lid finds that he cannot manage a rounded end to it, he can make it square, but he must bear in mind that the box must be square also.

AN OAK TEA-TRAY: HOW TO MAKE IT.

BY ALEXANDER MARTIN.

The days when highly decorated iron tea-trays were a necessary in every parlour are past and gone, but the fashion seems to be setting in again, though, instead of iron, wood is the material employed in their manufacture. Oak tea-trays are so easily made, and are so pretty and useful when they are made, that the following lines may be interesting to most of the large army of woodworkers.

The general view in Fig. 1 gives an idea of the nature of the tray, and a section of the edge, or rim, is given full size in Fig. 2. From these it will be seen that the sole of the tray is the foundation, and the rim is mitred on it. In selecting the wood for the sole, it should have as little heart in it as possible, so as to reduce in the greatest degree the tendency to "cap." The moulded rim planted across its ends will act to a certain extent in keeping the sole flat; but every precaution ought to be taken to ensure the sole keeping as level as possible.

The handles consist of three turned pillars each, two screwed to the rim and sole and a cross-piece between them. Fig. 3 shows nearly full-sized drawings of these turned pieces, the dotted lines indicating the portions which are hidden, but necessary for constructing the handle.

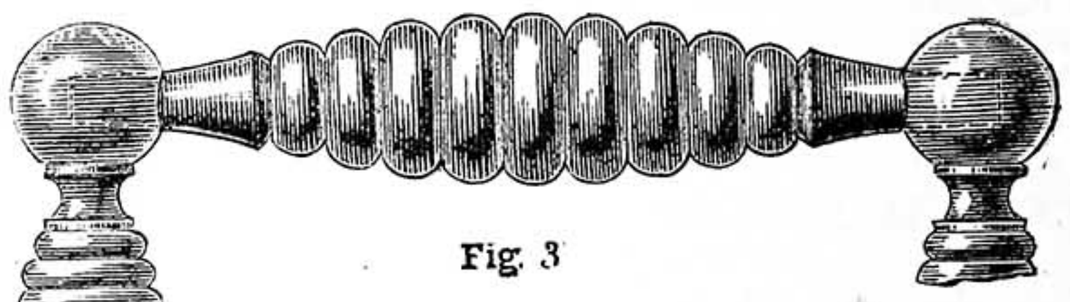


Fig. 3

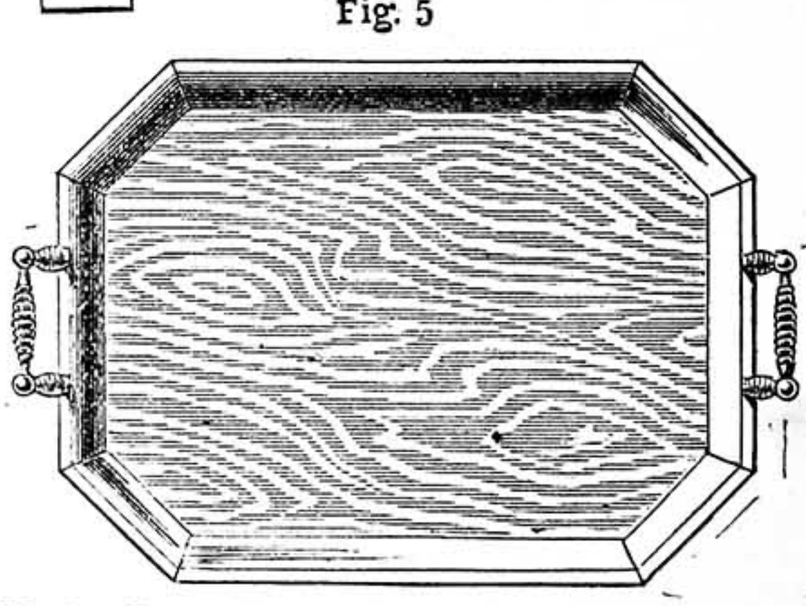


Fig. 1

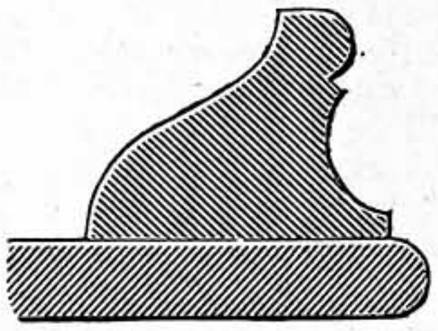


Fig. 2

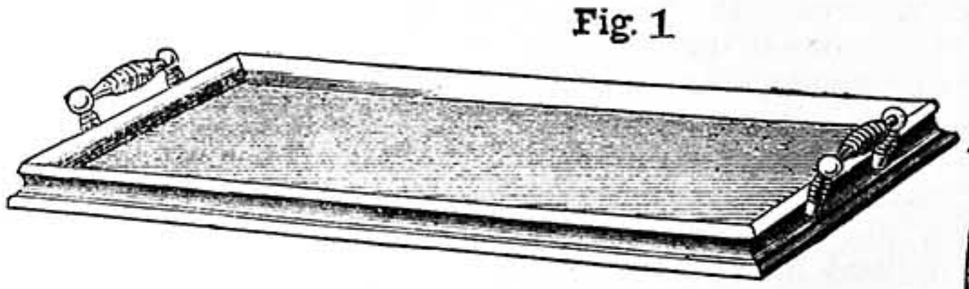


Fig. 5

Fig. 7

Fig. 6

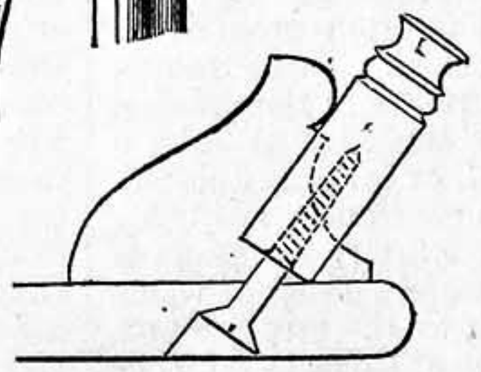


Fig. 4

Fig. 1.—General View of Tray. Fig. 2.—Section of Rim. Fig. 3.—Handle (full size is 3¾ in.). Fig. 4.—Mode of securing Handle. Fig. 5.—Tray with Canted Corners. Fig. 6.—Tray with Rounded Corners. Fig. 7.—Block to form Corner.

The plain portions of the two uprights are set into the moulded rim a little bit, and then a screw is put into each from underneath and the handle is firmly secured. This must be carefully and strongly done, for it might be a serious matter if the handles gave way when some choice china was being carried in the tray. Then there would be lamentation! The illustration in Fig. 4 represents the method of securing the handle already mentioned, and if this be carefully executed there need be no fear. This completes the tray.

Another form is given in Fig. 5, with canted corners, otherwise it is exactly the same as that shown in Fig. 1. Yet another way of treating the corners is shown in Fig. 6, where they are rounded. These round corners may be turned in a circle, cut in four, and then placed in position; or a block may be cut to the shape and planted in the corner as shown in Fig. 7, the various members of the moulding being carved out after it is glued firm. Either way, the result is the same.

The size of the tray must be regulated to a great extent by individual taste; but a good useful dimension is 18 in. long by 14 in. wide for the size of the sole. Another size larger might be 21 in. long by 16½ in. wide; while a smaller size would be 15½ in. long by 11½ in. wide. Of course, any intermediate dimensions may be decided upon; but the reason for giving these particular sizes is that, while they are convenient by themselves, they also form a capital set of three.

In finishing such trays as these, the oak may be treated in different ways. It may be polished its natural colour or it may be stained a nice rich brown. Then, again, the sole may be light and the rim dark, the sole dark and the rim black, or the sole light and the rim black; this latter way has a very smart appearance indeed, and is the writer's favourite arrangement. The handles are always best to be dark, unless metal handles be substituted for wooden ones, in which case they should be electro-plated.

HOW TO IMPROVE THE APPEARANCE OF PLAIN CEILINGS.

BY T. R. BLACKETT.

In the majority of houses the ceiling presents a plain, flat expanse of white, without anything to relieve its monotony; sometimes a cornice is run round the room, which improves it a little, but in very few cases is anything done to improve the remaining portion of the ceiling. In the present article it is proposed to show how, by a very little extra expenditure, the appearance of the ceiling may be greatly improved.

In commencing to colour or whitewash a ceiling, it should first be washed with a brush and clean water, to remove all dirt, stains, etc., and, when dry, any rough places should be scraped or rubbed smooth, and all cracks filled up with plasterers' putty, or Paris white, mixed with a little plaster of Paris, to make it set. The cracks should be wetted with a brush, and the putty squeezed in with a small trowel, and rubbed down smooth. If the stains cannot be got off by washing, the ceiling should be painted white, in flat colour, or paint mixed with turpentine. Then commence to whitewash from one corner of the room, going over it as quickly as possible, and finishing with straight, even strokes, so as not to show any brush-marks. The strokes of the brush should be made towards the portion already whitewashed, so as not to show a join.

To mix the whitewash, break up the Paris white and put it into a bucket, putting as much water on as will cover it, and let it stand for a few hours; then pour off any clear water which may remain on the top, and mix it up with thin glue, or patent size which has been melted, in hot water. A little blue added to it will improve the appearance. After mixing it should stand for a few hours, when it will be ready for use.

After the ceiling is whitewashed, and dry, make a mark with a chalk line 6 in. from the cornice or walls, and get some narrow wall-paper bordering of suitable colour, and paste it on to the chalk lines, putting corner pieces at the angles; the bordering should be 1 in. or 1½ in. wide, and should be put on quite straight. If desired, the space between the bordering and the cornice may be tinted.

Or instead of using the bordering, colour a margin 6 in. wide all round the ceiling, and at a distance of 1 in. or 1½ in. from this, paint a line of chocolate ⅜ in. or ½ in. wide all round, and stencil an ornamental pattern at each angle. The edge of the coloured margin should be kept perfectly straight, and the chocolate lines should be painted to a rule, or straight-edge, held against the ceiling.

If there be a cornice, it should be washed, the cracks filled up, and whitewashed in the same manner as the ceiling, the cove, or large hollow, being tinted the same colour as the margin on the ceiling, but the other members of the cornice will look better white, as when tinted it gives the cornice a heavy appearance.

If the ceiling is large it may be divided into four panels, as shown in Fig. 1, the shaded part representing the colour. The width of the margins may also be increased in a large ceiling.

Fig. 2 shows another method of dividing a ceiling into panels, a circular margin being formed in the centre, round the chandelier.

Before laying the colour on it should be tried on some surface and allowed to dry, as if made too dark the ceiling will have a heavy appearance. Pink or salmon colour will be found very suitable colours for the margins, although others may be used: the stringing lines and stencilling will look best in chocolate, or similar dark colour.

Figs. 3 and 4 show two other forms of dividing the ceiling, which have a very good appearance. The centre portion of the panels may also be tinted, if desired, to a very light shade of the colour used in the margins; but when the room is low it is advisable to have the colours light, while for a lofty room, well lighted, a darker shade is sometimes an improvement. Each drawing represents one-fourth of the ceiling.

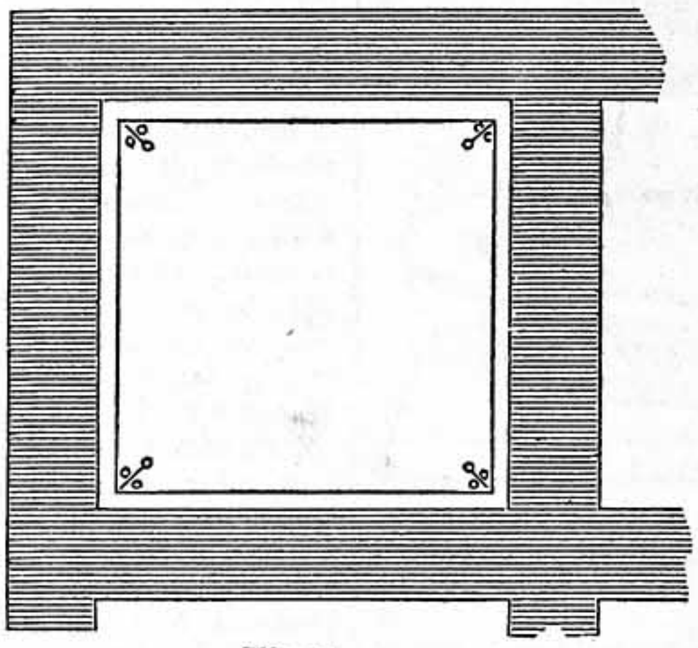


Fig. 1.

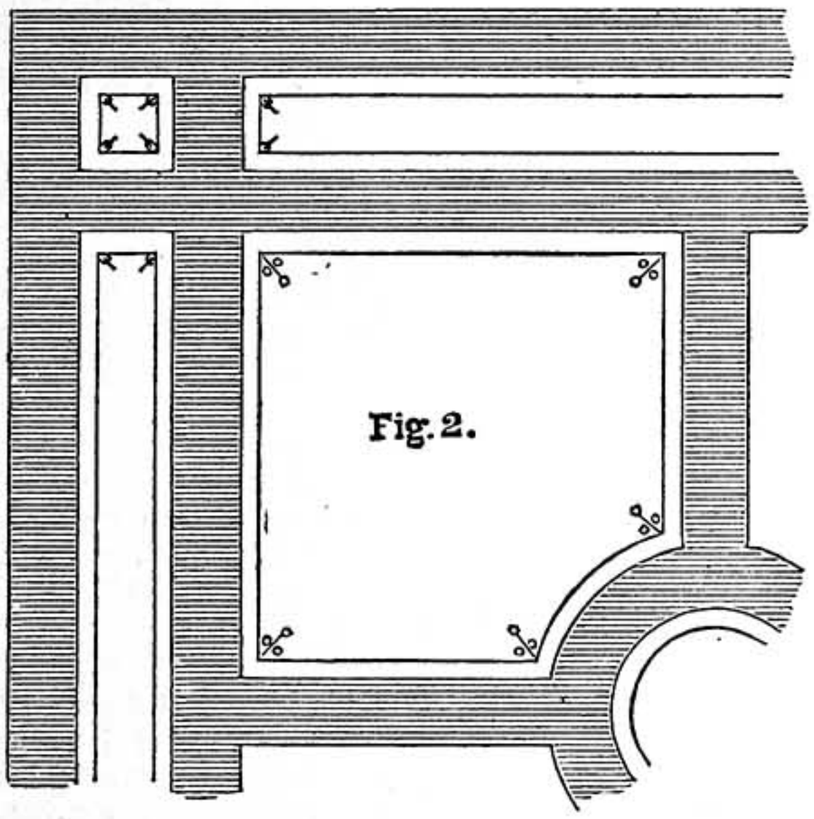


Fig. 2.

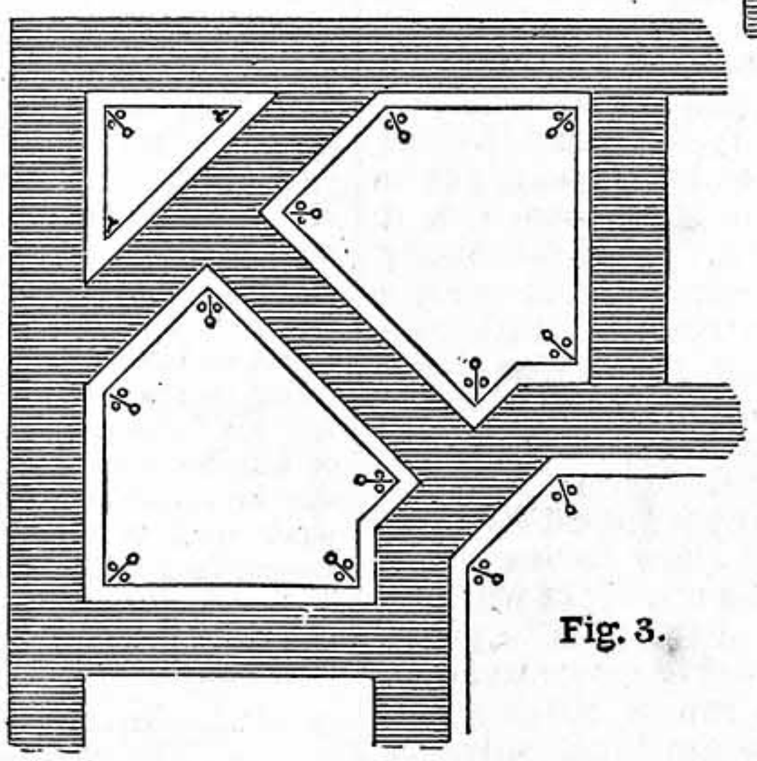


Fig. 3.

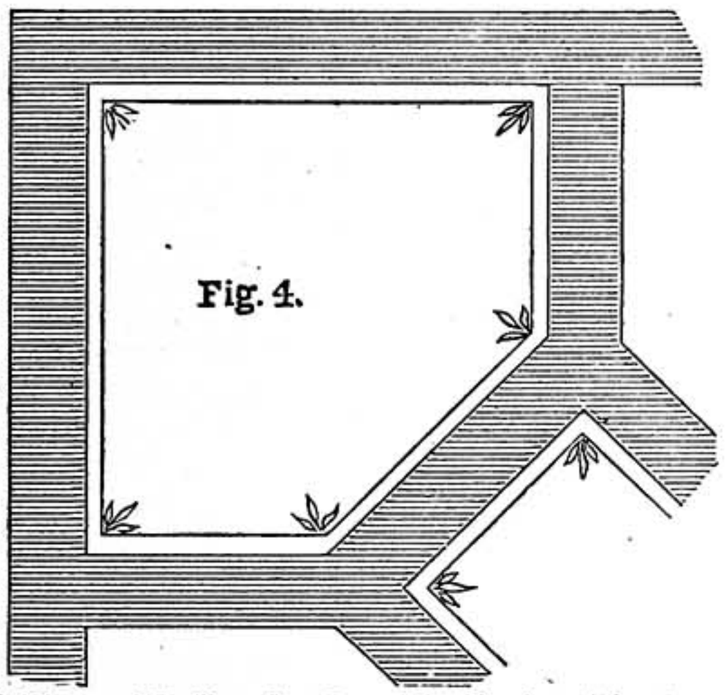


Fig. 4.

Fig. 1.—Ceiling divided into Four Panels. Fig. 2.—Ceiling with Circular Panel in Centre. Fig. 3.—Ceiling with Octagonal Panel in Centre. Fig. 4.—Ceiling with Square Panel in Centre.

A USEFUL DRILLING TOOL.

BY J. THOMPSON.

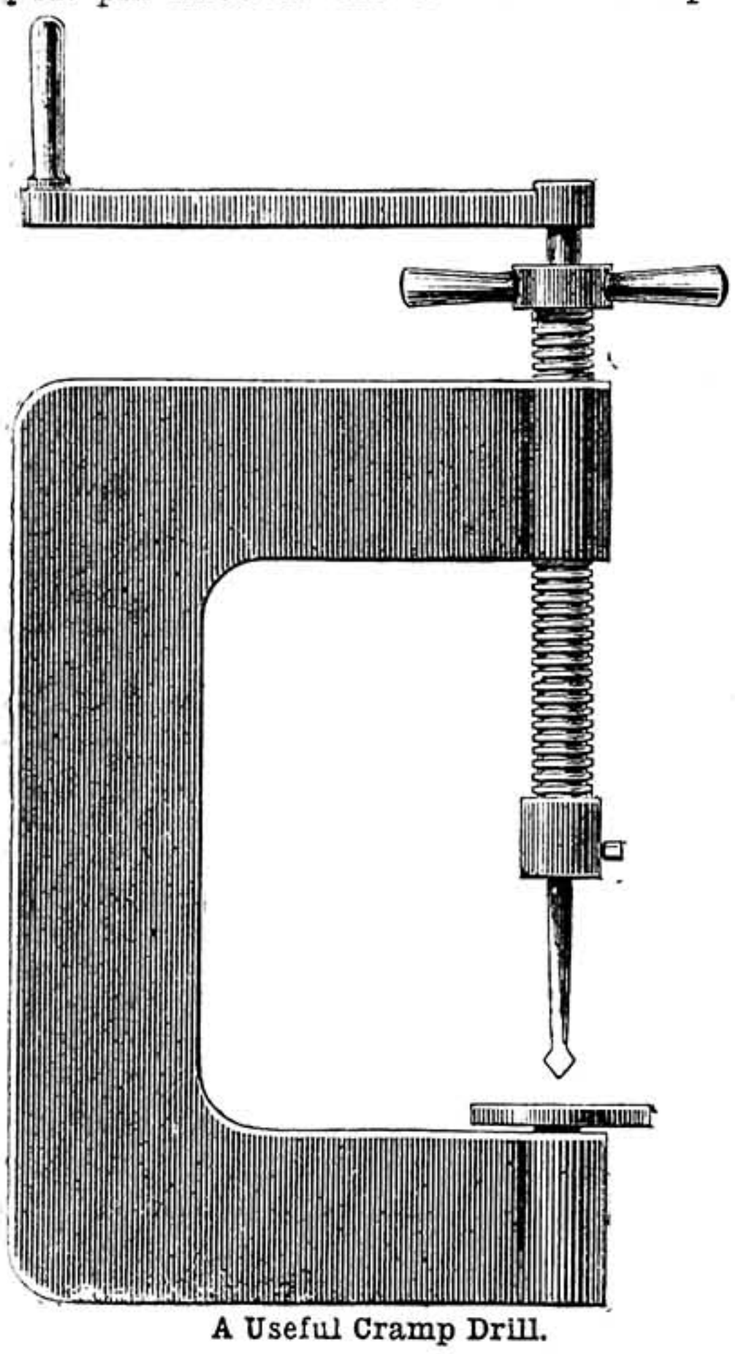
This drill, sometimes called a cramp drill, is a very useful tool, as it can be used in almost any position, and, by the addition of two lugs on the lower part of the frame, could be bolted to a bench. As it has not been described in this Magazine, a description of it may be interesting to some of the readers.

The tool is shown in the accompanying

illustration. It consists of a frame, with a screw fixed in the upper part; the drill spindle passes down the centre of this screw, having a projection on the lower end upon which the screw bears. The screw can be raised or lowered by means of a handle fixed on the top. A handle is fixed to the drill spindle for working the drill, pressure being given to it by the screw. A small table is fixed at the lower part of the frame, upon which the work rests while being drilled. The frame is made of wrought iron, 3 in. by ½ in., the ends being bossed for the screw and table. The hole for the screw is 1⅛ in. in diameter, tapped for the screw, and for the table ¾ in. in diameter; they must be drilled in line with each other. The screw is a hollow tube of wrought iron or steel, with a handle fixed on the top.

The drill spindle is ⅝ in. in diameter, of steel, the lower end being made 1¼ in. in diameter, with a ½ in. hole drilled in it for the drills; it must fit the inside of the screw without any shake. The screw may be cut on the tube by a pair of stocks and dies, or in a screw-cutting lathe. In the latter case, it will be mounted on the spindle while cutting the screw, to keep it central. The top end of the spindle projects above the top of the tube, and has four flat faces filed upon it for the handle to fit on.

The handle is 10 in. or 12 in. long, fitted on the top end of the spindle, as shown. The table is 3 in. or 4 in. in diameter, with a ¼ in. pin fixed in the centre. The top of



A Useful Cramp Drill.

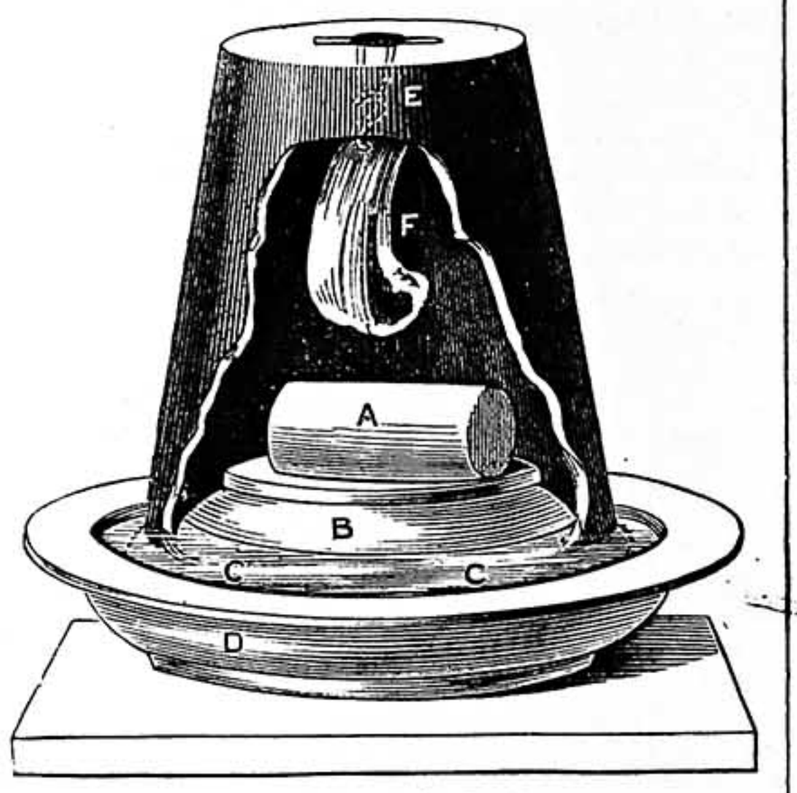
the table and the pin should be turned, so that any work fixed on the table will be drilled true and square. The shanks of the drills are turned, so that they run true, and a flat is filed on one side, by which they are fixed in the drill spindle with a set-screw.

No amateur wood-worker should be without some sort of drill to enable him to do such drilling in metal-work as he may be called on to execute in connection with wood-work. A metal-worker will be furnished with bigger and more powerful drills.

A CHEAP BUTTER COOLER.

BY D. WILLIAMS.

Most housewives know how difficult it is to keep their butter firm during the hot weather, and how unpleasant it is to find the butter to be almost like oil. Well, here is a cooler which has these four advantages: (1) it costs practically nothing—a great consideration in these struggling days; (2) it is



A Cheap Butter Cooler—A, Roll of Butter; B, Saucer; C, Water; D, Dish; E, Hook for Meat; F, Piece of Meat.

perfectly equal to any refrigerator; (3) it is quite simple, and capable of being cleansed easily; (4) it is based upon sound scientific and hygienic principles. To make it, get an ordinary flower-pot (unglazed, of course), a saucer, and a glazed plate or dish. These are all that are necessary. Thoroughly clean the flower-pot inside and out, and dry it in a current of air, or the sun; then soak it well in clear cold water. Place the butter upon the inverted saucer; stand the saucer in the dish, which you must fill with cold water, taking care that the water is not high enough to reach over the top of the saucer; and then place the flower-pot over the saucer, and your cooler is made. It will keep your butter hard in the hottest weather: the hole at the top will allow free access of air, and the porous sides of the pot will hold the water, and yet permit the air to percolate through. This kind of cooler has been tried during a severe run of hot weather, and has been found to act beautifully. It can also be adapted for small joints of meat by bending a piece of wire as shown in the illustration, inserting the loop-part through the hole, and hooking the meat on inside. In this case the pot should stand upon two sticks, to allow the air to pass underneath. Flies will not readily go under the pot, and if the water be kept above the lower rim it will exclude them entirely; or a wire-gauze dish-cover could be placed over the whole. Still, as a meat-safe it is not so efficient as for a butter cooler; and, if it is once tested, there are few housewives who will again submit to the butter going oily or turning rancid. The accompanying sketch will show how the article is made. One thing to be remembered is: do not let either the inside or outside of the flower-pot get greasy or dirty. The oftener it is scrubbed, the better will it act. Grease or dirt prevents the water soaking into it, and the cooling properties become impaired.

The utility of a cooler of this kind will be far more apparent when one has been made and brought into use.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

119.—"The Optics of Photography and Photographic Lenses."

The book that bears this title is published by Messrs. Whittaker & Co., London, and is written by Mr. J. Traill Taylor, editor of the "British Journal of Photography." It forms one of the series known as Whittaker's Library of Arts, Sciences, Manufactures, and Industries, and, as the author takes care to explain in the preface to his work, "is not theoretical but practical, and it is not intended for the makers, but the users, of photographic lenses." He further explains that, although there are many lenses in the market which are not even mentioned by name in the volume, inasmuch as the chief difference in thom is to be found in the variations of diameters, foci, and curves of the lenses, and their distinction by special trade terms, he has wisely preferred in all cases to deal with the lenses in classes associated with the name of the first inventor of each particular kind. The book is well conceived, and written in the clearest terms, and cannot fail to be useful to every photographer who desires to thoroughly understand his business and to comprehend the nature of the instruments and appliances he uses.

120.—"The Practical Telephone Handbook."

This is another volume of the series mentioned above, and is issued by the same enterprising publishing firm. It is written by Mr. Joseph Poole, Chief Electrician to the late Lancashire and Cheshire Telephonic Exchange Company, Manchester, and a Whitworth Scholar of 1875. Although, considering the importance of the subject, the manual itself is of moderate size and cost, yet it is thoroughly practical, and gives in detail, as far as the space will admit, the most recent methods of telephonic working. It is not only a volume suited to meet all the requirements of telephone *employés*, but one which affords all the information necessary to users of the telephone and to all who desire to acquire some knowledge of the nature of the instrument and its construction and use. The text is elucidated by nearly two hundred and thirty diagrams and illustrations.

121.—Quarterly Supplement to the "Wood Carver."

This is not the *Wood Carver* noticed in page 474 of this volume, but a work from the pen and pencil of Mr. J. S. Gibson, of Edinburgh, and published by Messrs. Scott & Ferguson and Menzies & Co., of that city, and Messrs. Simpkin Marshall & Co., of London. It contains thirty-four full-sized designs of useful articles, with practical instructions in carving, modelling, etc. The Supplement to this desirable work—which should be in the hands of all wood carvers—is issued quarterly. The one before me contains bold and well-executed designs for panels for a lamp-stand, the back and seat of a spinner's chair, a photo frame, and a brief paper on "The Study of Historic Ornament," with two appropriate illustrations.

122.—Melhuish's Illustrated Price List of Cabinets.

Amateurs who are desirous of obtaining a handsome tool cabinet with work bench and other accessories in combination should not fail to send for Messrs. R. Melhuish & Sons' new catalogue before purchasing. Space unfortunately prevents me from making more than this very brief mention of Mr. Melhuish's specialities in this line.

The Editor.

Notice as to New and Important Features to appear in

"WORK."

SUCCESSFUL as "WORK" has been during the three years which have elapsed since the First Number was issued, the

NEW AND VERY IMPORTANT PAPERS

which will appear in the next and forthcoming Numbers will, it is believed, still further extend the circle of its readers and the sphere of its usefulness.

Amongst the Special Series of Contributions for which the Editor has already arranged, and which will be in addition to the usual variety of papers, may be mentioned :—

Original Designs in Art and Ornament for all Art Workers.
Induction Coils and Electric Work in General.
Bent Iron Work—Affording an Occupation for Women.
Staircasing and Handrailing—for Professional Workers.
Chemistry Appliances, and How to Make Them.
Designs and Studies in Home Decoration.
How to Learn "Drawing Office Work."
Furniture—Original Designs in.
Photographic Appliances, and How to Make Them.
Coach and Carriage Painting.
Microscopic Appliances, and How to Make Them.
Stories of Great Engineering Triumphs.
Pages of Easy Carpentry.
The Spectroscope: How to Make and Work It.
Tools: How to Buy, Select, and Handle Them.
Practical Papers on :—How to Whitewash a Ceiling.—How to Purify the Cistern.—How to Control the Gas Meter.—How to Put on a Lock.—How to Mend a Window, etc.
How to Grind Optic Lenses.
How to Learn to Design. By a Member of the Arts and Crafts Guild.
Sewing Machines: How to Select and Work Them.
Poker Work, and How to Do It. By a Danish Art Teacher.
Telescope Making and Working. By a Practical Hand.
Country Carpentry: Being a Series of Papers on Profitable Outhouse Building.
Workshop Joinery in all its Stages.
Slaters' Work. By a Master Slater.
Plasterers' Work. By a Working Plasterer.
Jewellers' and Silversmiths' Case Making.
Stained Glass Window Making—Domestic and Ecclesiastical. By a Foreman Worker.
Work and Power Papers. By a Civil Engineer.
Design and Decoration of all Ages :—1. Barbaric Art.—2. Greek.—3. Celtic.—4. Early English.—5. Chinese.—6. Japanese.—7. Indian.—8. Naturalistic.—9. Conventional.—10 Grotesque.—11. Ecclesiastic.—12. Application of Styles.
Embroidery: Its Principles, Purposes, and Practical Application.
Simple Arts for the Cottage.
How to Make an American Organ. By a London Factory Foreman.

A notable feature of the New Volume will be the weekly publication of

TRADE AND LABOUR NOTES, AND NEWS

from the principal trade and industrial centres. The Editor has secured the co-operation of leading men holding responsible official positions, whose notes will thus possess a peculiar value, and be of special importance to all workers.

Arrangements have also been made by which the Editor hopes to secure from time to time direct intelligence from Colonial districts offering fields and opportunities for emigrants and workers who suffer from the overstocked condition of the home labour market.

There will also be a separate column devoted to a

WEEKLY SURVEY OF SCIENCE,

in which the latest developments of practical science will be chronicled in a concise and readable manner.

Thus it will be seen that "WORK" will even more fully than heretofore carry out its aim of furnishing clear practical exposition, as well as Designs and Illustrations, of

EVERY ART, CRAFT, AND SCIENCE

that bears directly or indirectly on handiwork of a constructive or decorative character, and at the same time serve as an index to the worker upon questions and matters connected with labour and the labour market—the fluctuations in which so immediately affect him, and in which he must necessarily feel an active interest.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London; and all Booksellers'.*

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given.*

I.—LETTERS FROM CORRESPONDENTS.

Plain Sketches.—THEO D'OLITE writes to T. P. (*Frodsham Bridge*) (see p. 717, No. 149) :—"C. E. is, I think, incorrect in supposing that Maxton's very complete work on Engineering Drawing is to be found in Spon's catalogue. My copy is one of the Weale Rudimentary Series published by Crosby Lockwood & Co. I should advise T. P. to get it by all means; he will never regret the expenditure of 4s. 6d. less."

Violin Making and Varnish.—H. H. (*Latchford*) writes :—"Having found a difficulty in bending the ribs of a viola so that they would retain their shape on the mould, I set about making a 'bender;' and as it is a great success, I send you a rough sketch of it for 'Shop.' It is heated by placing a piece of round iron bar red-hot into the tube. For convenience' sake I have put a wooden handle on the heater. The ribs are passed between the bar and the tube, and bent over the latter. A thin wedge of hard wood is useful for clipping the ribs to the tube where necessary, but the bar is intended to act as a grip. I have just bent some 'cello ribs cut from maple, and they retained their shape splendidly. As anything that saves time and patience is worth knowing, I send you the sketch without further remarks. The articles which recently appeared in WORK on Violin Making, though in themselves the best of the kind ever written, left the matter of varnishing in a very vague state. I suppose this is through violin-makers guarding their trade secrets very closely. There has been a great deal of nonsense written about the old makers' so-called amber varnish. My

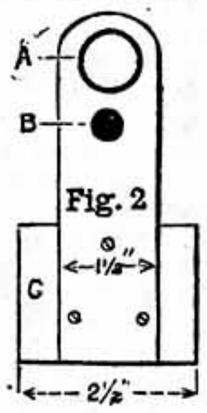


Fig. 2

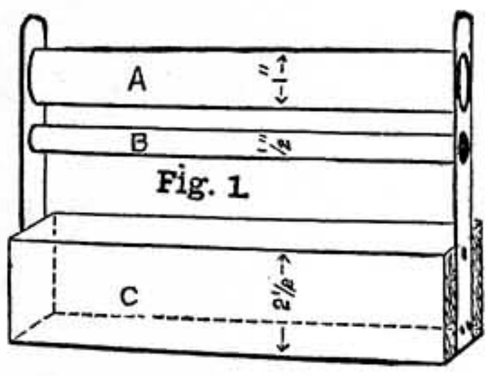


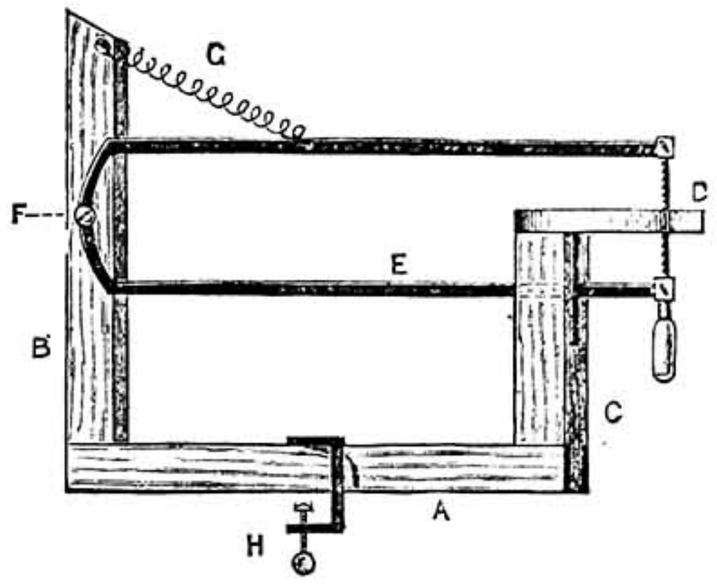
Fig. 1

Violin Bender. Fig. 1.—A, 1 in. Iron Tube, either turned or smooth; B, ½ in. Round Iron Bar; C, 2½ in. Wood Block. Fig. 2.—Section—A, 1 in. Tube; B, Bar.

own opinion is that the old varnish was a very simple affair—how could it be otherwise, seeing the outlandish places these people lived in? With this view I have recently been experimenting in varnishes, and have succeeded in getting one which I think will satisfy anyone. I cannot give you the exact quantities, but I will tell you how I made it. I procured 2 oz. juniper gum, ½ oz. elemi, ½ oz. myrrh, ½ oz. benzoin. These I dissolved separately in methylated spirit previously coloured (just sufficient spirit to dissolve the gum). For colouring I used: yellow, gamboge; red, alkanet root, or dragon's-blood; brown, aloes. When thoroughly dissolved, I mixed the gums with about 3 oz. linseed oil (boiled), added 1 oz. turps, and boiled altogether in a water bath until a great proportion of the spirit had evaporated. This I poured into a bottle when cold, and the result was a sort of jelly. I added about a tablespoonful more spirit, and shook the lot up, and in a day or two the jelly broke up, and a beautiful clear varnish rose to the surface, whilst the undissolved gums and oil remained at the bottom. I poured off the clear varnish, and put a little spirit in what was left, gave it another shaking, and did as before. This process I repeated till there was nothing left but the excess of oil and the foreign substances and dirt which are in all gums. This varnish takes about twenty-four hours to set, and it should be strained through fine muslin before use. It requires about six coats to varnish a violin. The violin should be oiled in before commencing, and each coat should be rubbed down with oiled felt. It is better for keeping a month or two; and although anyone who tries it may fail in the first attempt, yet it is well worth any trouble you may have. A mixture of brown and red makes a very nice colour. The yellow is rather light for some tastes, although I consider the viola I varnished that colour looks very well."

Needed Inventions.—B. A. B. (*Hampstead*) writes :—"There is a need for a sash pulley that can be easily oiled, or else composed of such metals as require no oiling. It should be similar in appearance and dimensions to those now in use, so that the old ones may be easily replaced by a better pattern. A pulley suitable for the balancing of side lights of bay windows, where there is no room for sash weights, would sell. The only disadvantage of such a mode of hanging sashes is that when the lower sash is raised the upper one descends; but that is better than both being fixed, as they are generally made at present."—[Thanks for these notes for needed inventions and requirements. We wish you and every reader of WORK would begin and continue to favour us with any necessity of this kind as it comes before you, whether in practical work or idea only, in order that prominence might be given to such useful suggestions in WORK.—ED.]

Fret-saw Contrivance.—W. S. (*Cambridge*) writes :—"I send a rough sketch of a hand fret-saw contrivance. Two great advantages of it are: it cuts the work true, like a treadle machine; also, it leaves the hands more at liberty to thread the saw through the work, and costs but a few pence—that is, if you have the saw-frame by you. Of course, you can buy these made in first-class style, but they then come to 6s. or 7s.; mine cost me only 2d. for spring and screws, as I had frame and cramp by me, and wood from an old soap-box. Let me say it



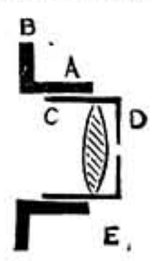
Hand Fret-saw Contrivance.

is all made of wood, screwed together, and those handy with their tools can dovetail the uprights into the base-board. A is the base-board, 4 in. wide (or about) and 1 in. thick; B the upright to which the saw-frame is screwed with a small round-headed screw, with just enough play to work the saw up and down easily; C, upright to which the table, D, is attached. Run the saw down C for the lower half of the steel frame to work in, which also acts as a guide for the frame; screw table on top of C, and bore a small hole through table, D, just where the saw must go through. G is a spring from the frame to the uprights; H, cramp by which to clamp the base-board to the table or bench. All the wood would be best 1 in. thick except the table, which may be ½ in. hard wood, either round or square, but must be smooth on top to move the work easily when sawing. It will be seen that two small holes will have to be bored in the saw-frame, E, one for screw in centre of back, and the other for the spring in the top part of frame. The length of base-board and uprights depends on the length and width of saw-frame."

Etching on Tools.—LOST MOTION writes :—"I have noticed several recipes for etching names on steel tools in your 'Shop' columns, and can from personal experience confidently recommend blue vitriol, or sulphate of copper, and common salt. After coating the blade with wax, and scratching in the name with a needle or some other fine-pointed article, sprinkle over the scratched place some finely-powdered sulphate of copper, and cover this with common table salt; leave for twelve hours, at the end of which time the name will be found *deeply* bitten in."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Camera Lens.—SUNMAN.—The explanation of the two brass tubes is this: The brass tube to which is attached a flange is intended to be screwed into the camera to hold the other brass tubes in which the lenses are fixed. Each pair of lenses, forming combinations of different focal length, can thus be easily adjusted for working. If only one combination is wanted, it can be fixed in the single tube with the flange, two tubes being unnecessary. Any camera will suit these lenses, providing they will draw out sufficiently far to focus.—D.



Camera Lens—A, Outside Tube; B, Flange; C, Inner Tube; D, Stop; E, Lens.

Honeycombed Holes.—C. T. (*Bradford*).—Put a bit of soap, about the size of a five-shilling piece, into the metal just before pouring; stir it round for a few seconds, and pour slowly, without splashing, from one end of the ingot mould. Nothing more is needed to ensure sound ingots.—J.

Model Loco' Boiler.—E. W. L. (*Newcastle-on-Tyne*).—You can do nothing with it except throw it on the scrap heap. It is too small for charcoal, and is not rightly made for a spirit-lamp. Have nothing to do with these trashy bought engines. If

you want a *working* model, you must either pay a good price or spend a lot of your own labour in constructing one. Cheap engines of this type are simply useless.—J.

Cork Picture-Frames.—W. R. W. (*Colne*).—I imagine this to be too trivial an art to have any book specially devoted to it—at least, I know of none. Within the narrow limits of the "Shop" columns, any designs which I could give would be too small to be of practical use; but our Editor promises the space, and I will give what you require as soon as possible in a short illustrated article.—A. Y.

Magnetism.—H. A. B. (*Middlesbro'*).—(1) When a piece of iron is placed in contact with one leg only of a horse-shoe magnet, some of the lines of force are lost in air, since they spread around the edges of the steel bar and are not concentrated in the iron armature. When, however, the soft iron armature is placed in contact with both legs, some of the lines between the poles are also taken up, and, as a consequence, the hold is more than double that of one pole only. The relative difference may be ascertained by boring a hole in the armature and suspending from it a small scale pan, then adding small weights until the attractive force of the magnet is overcome by the added weights. (2) I have no data at hand to guide me in answering your second question. As the coercive force of magnetised steel is high, it will not be much affected by the earth's magnetism. At the same time, reasoning from theory, one would suppose that the magnet with its south pole pointing downwards would be weakened, and the other slightly strengthened. What is your experience?—G. E. B.

Battery for Electro-Motor.—R. McG. (*Govan*).—As the working resistance of the electro-motor is low, you must employ a battery giving a large volume of current with a low internal resistance of the cells. Batteries suitable to this work, having a low internal resistance, are the Bunsen, the Grove, and modifications of these for use with chromic acid. Get a set of four Bunsen cells, taking a quart of liquid to charge each cell, and charge the porous cells with a mixture of chromic acid, 3 oz., chlorate of potash, ½ oz. in each pint of water, made acid with 3 oz. of sulphuric acid. Charge the outer cells containing the zinc cylinders with a mixture of one half-pint of sulphuric acid to each ten half-pints of water. In Nos. 1 and 2 of WORK you will find a full description of the Bunsen battery. These numbers will cost you 3d. by post. If you have the back numbers containing the articles on "Model Electric Lights," you will find some suitable batteries for your motor described in the third article in WORK, No. 89.—G. E. B.

Zither.—S. S. (*London, W.*).—An article on the Zither appeared in No. 129, and "Hints on the Stringing of the Zither" in No. 139.

Magnetic Needle for Telegraph Instrument.—TELEGRAPH.—A telegraph instrument of the single needle type has two needles: one on the outside of the dial to act as a hand or pointer, and one inside the instrument, behind the dial. Both are fastened to the same spindle, and therefore both move together. The outside needle need not be magnetised, but the inside needle must be of hard magnetised steel. This is, I presume, the "small plate in the back" mentioned in your letter. It works inside a coil of very long fine wire, much the same as in a galvanometer. A paper showing how to construct a galvanometer is in the Editor's hands; and as the coils and needles of both instruments are the same, you will do well to follow the instructions given in that article. The lozenge-shaped piece of steel to go inside the coil may be magnetised by drawing its ends several times over the ends of a permanent magnet, such as a horse-shoe magnet, or winding it with a coil of silk-covered wire, and sending an interrupted current from a strong battery through the coil.—G. E. B.

Cutlery Case Making.—J. S. (*Amsterdam*).—There are two ways in which the "puffing," as it is called, is carried out. The formal way you refer to is done by machine, and the best work we know of carried out in that manner is by Messrs. Dewsnap, cutlers' case maker, Sheffield. The other form of puffing, which is irregular in appearance, and, to our mind, the most effective, is done by hand in the following way: Cut to the size required a sheet of paper—the sort usually employed in the trade is called "ledger" paper, and is, in fact, procured from old account books of good quality; place on this a layer of wadding, and then cut the satin about one-third larger than the "cushion," as the combined paper and wadding is technically named. The satin is then glued all round on back edge of cushion in small pleats equally distanced. When the glue has dried, the satin is arranged in puffs, as small or as large as taste or the size of the cushion may dictate, and these puffs are fixed or kept in position by lightly sewing right through the wadding and paper with needle and silk thread matching the satin. The machine for corrugating or ribbing pasteboard is made by the employment of two steel rollers with fluted surface all round, held in a framework precisely as the ordinary wringing machine used in laundry work. The rollers are adjusted so that they cog into each other when the handle of machine is turned, the space between the rollers being regulated by a screw. But the corrugated pasteboard itself is quite an ordinary article in the market, and can be obtained so cheaply that, unless the pleasure lies in the constructing of the machine, it seems hardly worth while going to the expense of making the machine to produce it. This corrugated board is largely used by wine merchants for bottle packing, by silversmiths' case makers, and others, and can be obtained from Messrs. Munt & Son, Cross Street, Hatton Garden.—P.

Lens.—W. R. R. (*Carlisle*).—There is no better all-round lens than a good rapid rectilinear of 8 in. focus. By removing one of the combinations from the mount, the remaining one makes an excellent landscape lens, providing the camera will rack out sufficiently. The exposure will, of course, be longer in proportion to the extra length of focus. If half second is required with the complete lens, two seconds will be necessary for the half of it. *Any* of the numerous photographic dealers will supply your requirements. We can scarcely recommend one before another. All dealers charge about the same for the same quality of goods, unless a speciality is made of any particular class. The weekly periodicals and WORK teem with advertisements.—D.

Gold Colouring and Suitable Alloys.—R. C. (*Battersea, S.W.*).—In the first place, the best book for practical information is G. E. Gee's "Goldsmiths' Handbook," published at 3s. by Crosby Lockwood & Co. This deals at much greater length than I can with the alloys, colouring mixtures, etc. Get it by all means; there are many useful tips in it. Now for the special difficulties that you write about, the chief one being the different surface you get over the soldering seams to what you have over all the rest of the article. Your colouring mixture is all right, except that there might be a little more acid in it; the fault lays undoubtedly in the solder. In both the hard and the easy solder there is too much silver. ·040 should be plenty of silver to add to ·250 of 15 carat for the harder quality, and ·090 for the easy. If you calculate it out, you will find, I think, that your easy solder is less than 12 carat, and 12 carat is the lowest quality which should be coloured with the mixture you give. In our workshop there is added to the easy solder some metal like zinc. Now the use of zinc in an alloy causes it to melt at a lower temperature than the quality would if alloyed with silver and copper only, therefore a slightly higher quality of gold can be used for soldering than would otherwise be the case. You might get the book, and try Gee's recipes; but meanwhile, instead of your last alloy, try what a mixture made up of these proportions will do: 15 carat, ·250; silver, ·075; pure zinc, ·01. This is very much like what we use for a differently composed 15 carat to yours. The zinc must be added when the other metals are perfectly melted and ready to pour; and do not spare the borax. As to getting a paler colour on your work, surely this can be got by adding more water to the colour than you have done in the last stages. Write again if this does not clear matters up.—H. S. G.

Bronze and Gold Lines on Picture Mounts.—R. H. (*Lancaster*).—There are different ways of producing these lines. Were the work of a cheap character, I should mix bronze powder with varnish (the clearer the varnish the better), and thin with turps till the mixture would flow freely from a bow-pen or lining pencil. Work thus done will *not* be bordered by a greasy line. Pale gold-size may be used instead of varnish; the bronze will then be darker, but will not necessarily look amiss. A higher class of work may be made by first drawing the lines in isinglass or other water-size upon this, when dry, drawing the lines again in gold-size, and when the gold-size is just tacky, rubbing bronze powder over it. If real gold-leaf is used, it must be applied by this last process; but if the mount is porous, as mounts often are, more than one coat of water-size may be necessary, since gold-leaf does not adhere so readily as bronze powder. A water-size may also be made strong enough to fix the bronze or gold alone. When similar lines have to be repeated many times, as in photographic albums, the printer will do the work more cheaply than it can be done by hand.—S. W.

Type-Writing by Lithography.—L. J. K. (*Dublin*).—(1) "Can any sort of ink and paper be used with a type-writer, so that the type-written matter can be transferred to a stone to have a large number of copies produced by lithography; and if so, of what kind?" We are not aware that type-writing has been so applied, but we know of no reason why the plan should not be feasible. The ink, we presume, would have to be the ordinary lithographic transfer writing ink, for no other will adhere to stone, and the paper the ordinary litho transfer writing-paper, both of which our correspondent may get from Hughes & Kimber, Fetter Lane, E.C., or any other dealer in litho materials. We assume that his plan will be to rub down his stick of ink (which will cost him 1s.) to the thickness required, and in it to soak a ribbon or band similar to ordinary type-writing bands. It would be desirable that the face of the paper should *not* be handled, as any marked or soiled portions will readily roll up when transferred to the stone. It would also be desirable that the matter should be put upon the stone as soon after it is written as possible. These are the best suggestions we can give him, but he must bear in mind that they are suggestions merely, and that we cannot promise that they will lead to success. (2) "Is there any other surface—parchment, zinc, tin-plate, etc.—to which the copy could be transferred?" We presume not, unless the surface can be charged with some kind of composition for the transfer to adhere to. He does not say for what purpose he wishes to transfer to these surfaces. Are we to suppose that it is for the purpose of multiplication by lithography? If so, his chances of transferring successfully to a litho zinc plate will be much the same as to stone, and our suggestions given in reply to his first query will be equally applicable here. He can get a zinc plate, of any size, from the Litho Zinc Plate Co., Ltd., Hull. (3) "Is it feasible for an amateur to reproduce the copies, or must it be done by a lithographic printer?" We fear that it would not be feasible, unless the amateur were skilled in lithography.—S. W.

Stereoscope.—G. P. D. (*Aberdeen*).—Stereoscopes were mentioned on p. 521, Vol. II., of WORK, and on p. 541, Vol. I. I rather fancy that I have seen something concerning them in Vol. III.; therefore, when the index appears, I should advise you to search it.—J. S.

Kallitype.—J. A. (*No Address*).—No; the kallitype process is a rapid process, and the image produced by development, which would render it difficult to work for the purpose mentioned. It would produce white lines on a black ground. The thickness of the paper would interfere with this print being used as a negative, although it might be so used to produce black lines on a white ground. The paper may be had from Fallowfield, Charing Cross Road, London, W.C. We are now able to see how, without measuring, any definite quantity of saturated solution could be ascertained. The difficulty with all saturated solutions is to ensure that the *same* quantity of substance is contained in a given measurement, as the saturation *varies* with the temperature. In all exact measurements, so-called saturated solutions are never used unless the saturation at a *certain temperature* is stated.—D.

China Drilling.—TRYER.—The article upon "China and Glass Riveting" appeared in Vol. II., No. 53, p. 4. As regards the second part of your query, although you can get drills in London, I would advise you, in your case, to write to Mr. E. Claxton, Tower Street, King's Lynn, and he will make you just what you require. He is a practical man, and knows exactly what is wanted for the work. Explain that you have the spindle, and only need a diamond drill, and also mention if it is needed for light or heavy work.—W. E. D., JR.

Letters for Signs, etc.—H. H. (*Brighton*).—I think you will find Willing's Patent Enamelled Copper Letters as good as anything you can use, as they can be affixed to glass with ease, and look exceedingly well. They are also suitable for facias, signs, or anything of that kind. I have no doubt you could get appointed agent, and you could affix them yourself, as the firm supplies cement for the purpose, accompanied by printed instructions for use. Apply to Mr. J. Willing, Clerkenwell Green, London, E.C., enclosing business card and asking terms. As regards rubber stamps, not much is to be made out of them now, as so many are agents; but if you think you could do a little business in them, write to some firm for their terms. There are plenty of manufacturers to choose from. I could not undertake to say which is the best firm; but if you do not know of any, here are two or three addresses: Crystal Palace Marking Ink Co., 75, Southgate Road, London, N. (see advertisement in WORK); Ireton & Co., Gracechurch Street, London, E.C.; J. Berkley, Livery Street, Birmingham.—W. E. D., JR.

Cement.—CONSTANT READER (*Ottawa*).—One of the easiest cements to make is to dissolve isinglass in acetic acid by the aid of heat (a water bath—glue-pot—for instance), and it will join all the articles you name, but it won't stand water or damp. Pound the isinglass before adding the acid, and if it needs it, strain through a piece of muslin. Keep in a well-corked bottle. Or perhaps the following might suit you better. It is a little more trouble to make, but I believe it is a thoroughly reliable cement: Dissolve five or six pieces of gum mastic, the size of a large pea, in as much spirits of wine as will suffice to render it liquid. In a separate vessel dissolve as much isinglass (previously softened in water, though none of the water must be used) in rum or other spirit as will make a 2 oz. phial of very strong glue, adding two small pieces of gum ammoniacum, which must be rubbed or ground until they are dissolved. Then mix the whole together with a sufficient heat. Keep it in a closely-stopped bottle, and, when it is to be used, set the bottle in boiling water. You do not say if you need the cement in large quantities; if you do, you can easily increase each item. Strictly weighed articles are not needed, but simply a general adherence to the formula.—W. E. D., JR.

Hive Appliances.—G. S. T. (*Birmingham*).—(1) It would scarcely be right for me to name any particular dealer as being the *best*, but most of the large manufacturers are sure to have agents in Birmingham. If you write to Messrs. Abbott, Southall, London; Messrs. Blow, Welwyn, Herts; Messrs. Baldwin, Bromley, Kent; Messrs. Neighbour, of High Holborn, London, and ask for a catalogue and the name of their agent in your town, the information will more than repay you for your trouble. It is a pity hive-makers do not advertise more in such a paper as WORK. Many amateurs would, I am sure, become their customers for such things as they do not care to make for themselves. (2) The zinc you name would cost about 1s. 6d. (3) Cowan's "Guide-Book," at 1s. 6d., to be got from any of the dealers or booksellers, is as good as any.—APIS.

Distillation.—STILL.—Plenty has been written upon this subject, but I am unable specially to recommend any treatise for your purpose. The process is so simple that probably an encyclopædia

article would give all the information you want. You ask whether you can use your still for making perfumes. Certainly, but you must remember that only the coarser perfumes, such as those from orange and lemon peel, geranium leaves, etc., are made by distillation. The more delicate ones, such as those from violets, jasmine, etc., are extracted by grease, either by packing the flowers in lard (the process known as *enfleurage*), or in the *bain Marie;* the perfume being afterwards drawn from the grease by alcohol. Be careful how you use your still, or you will have the Excise authorities down upon you.—M. M.

Electric Bells.—W. H. C. (*London, S.E.*).—Articles on "Electric Bells" appeared in Nos. 12, 18, and 20 of WORK.

Caning Chairs.—A. H. P. (*Lewisham*).—I will take your questions *seriatim*. (1) Cane can be bought, ready for use, in Bethnal Green Road, at one or two shops close to the junction of the old and new parts of the road. A short sharp knife, a punch (often made of a stout broken bradawl), and a light hammer are the only tools required. Punch out old pegs from below. Cane can be split and made uniform by passing it under a sharp razor blade fixed at the proper distance from the block which forms the base of the tool. (2) I have seen caning done, and the two strips across and two strips along were done before the diagonals were put in. (3 and 4) The caning was done throughout before the pegs were put in, but the cane was drawn fairly tight, one strip of cane being laced through and brought back as many times as length will allow. (5) The wooden 3-ply seats are cheaper than cane seats, if you have to put out the caning. You can certainly fix the 3-ply seats yourself. The only other plan is to have a stuffed seat. (6) There are three different modes of caning, or rather, three prices: one with canes described as above, six rows in all, with a row as bead held down with cane staples—3d. and upwards is charged for this; secondly, the same without the bead; thirdly, a cheap plan adopted by the people who cane chairs in the street, who only use four rows, and often use the inner strips of cane for two of the rows: these having no smooth surface, get dirty and rough very soon.—B. A. B.

Cement.—KILN.—For filling up cracks in earthenware, I know of nothing better than plaster of Paris mixed with water. If mixed with alum water, it gets very hard indeed. This, perhaps, may answer your purpose better than with simple water, although the latter way is that which professional china-menders use.—W. E. D., JR.

Incubator.—INCUBATOR.—You can obtain glass tube and all other fittings from Mr. T. Stevens (see advertisement in "Sale and Exchange" column of WORK).—LEGHORN.

French Polishing.—W. B. (*Rushden*).—It is impossible to instruct you in the whole art of polishing in the limits of a "Shop" reply, but as you are a new subscriber, I will give you the outline of the *modus operandi*, as practised by myself. I cannot advise you to attempt a chest of drawers for a beginning, as probably you would only make a mess of it. Try your hand on some waste pieces or a smaller article; then, when practice begets confidence, tackle the larger job. If you can get to see a polisher at work, it will give you some insight into the method of using the rubbers. Your work being all smoothed and ready, it will first be necessary to fill up the pores of the wood. For this filling take a sufficient quantity of tallow, and work it well up with powdered whiting to form a stiff paste. Colour to match the wood (for mahogany I use portions of dry ochre, umber, and Venetian red); moisten, if necessary, with a little raw linseed oil, and with a piece of rag apply it all over the surface of the work across the grain, so as to fill all the pores. Now remove the surplus, and we are ready for polishing. If you wish to darken the wood, apply a weak solution of bichromate of potash before "filling." I, however, much prefer mahogany unstained. Now get some French polish (buy it at your nearest oil and colour shop), raw linseed oil, methylated spirit, wadding, a piece or two of flannel, and a supply of clean white rag. Take some wadding sufficient to make a ball about 2 in. in diameter (this is a convenient size, but it must be determined by the work in hand), cover this with a piece of flannel, and saturate the pad with polish. Now take a piece of rag, and enclose the pad in it, gathering the corners all together tightly, so as to present a circular surface to the work. When ready, pass the rubber over the work in light circular strokes, beginning at one end, and gradually traversing the whole of the surface to be polished, letting each stroke overlap the last. Moisten the rubber with fresh polish as the former lot gets used up, and continue the rubbing until your work presents a fairly even polish, increasing the pressure on the rubber as the work proceeds, and moistening the surface of the rubber with a trace of linseed oil if it shows any signs of sticking. Now put the work aside for an hour or two, to allow the polish to harden, and upon resuming, give it a rub with fine glass-paper to remove all inequalities, and proceed with a second coat of polish. When there appears a nice even coating, lay aside again to allow it to harden, and, if possible, leave it till next day, when you may proceed to "spirit off" the work—that is, to work out the oil so as to leave a clear bright surface. Make a rubber as before, and moisten with methylated spirit only, and go over the work in the direction of the grain with light quick strokes, until all cloudiness disappears. Spiriting off is the most difficult part of the job, as, if unskilfully done, the polish is apt to tear up in patches. Remember that practice makes perfect, and if at first you don't succeed, try again. I omitted to mention that all polishing operations must be performed in a warm room.—H. E.

Painting Slides.—BUSY BEE.—(1) "Is it within the power of an amateur to paint optical slides?" It depends on the ability of the amateur. Anyone with a fair knowledge of drawing, an eye for colour, and patience, could, I am sure, with practice produce really good results, and in time might even secure professional work. (2) "What kind of paint is used, and where procurable? What kind of brushes are best, etc.?" The paints used are those known as transparent, and can be bought of any dealer in artists' material. As BUSY BEE lives in London, many names will be familiar to him—such as Newton, Reeves, etc. The colours may be procured either as water or oil; BUSY BEE must decide for himself which he will elect to work with. I can only say here that the treatment of the work in each kind is different. The colours used are as follows: *Yellows:* gamboge, yellow lake, Italian pink, yellow madder. *Blues:* Chinese, Prussian, indigo. *Green:* verdigris. *Reds:* crimson lake, pure orange, burnt sienna. *Browns:* Vandyke, madder brown. These can be procured at about 4d. per tube; madder lake, French ultramarine, and pure scarlet at 1s. per tube. Besides paints, varnishes will be required—viz., copal and mastic—also gold-size and turps. Mastic 3 parts, and turps 1, are mixed with gentle heat with lampblack for outlines; mastic, ¼ oz., turps one teaspoonful, and 20 drops of gold-size to mix the colours. Brushes.—These must be sable, varying from 0 to 6, and one or two riggers made, I think, of ox-hair for outlining. In addition to these materials, an easel will be required of a skeleton kind, so that the slide shall simply be gripped and allow a piece of white paper to be seen through the slide. This will enable one to see how the colours are spreading. (3) The glass does not require any preparation beyond rendering it perfectly clean. The glass painting referred to in Vol. I. is for window decoration, and not for optical lanterns. When BUSY BEE comes to work, he will find difficulties which as yet he does not anticipate, but which, by patience, may be overcome. Look out for coming articles in WORK.—O. B.

Repairing Cycle Tires.—J. B. (*Eastbourne*).—I have to say that, in my reply to RETRENCHMENT (see p. 652, Vol. III.) anent pneumatic tires, if I remember rightly, the reference was to the "Dunlop" species of pneumatic tire. In that reply I adhered to a rule I have ever endeavoured to observe—namely, never to attempt giving information to others from theory, but only from my own personal experience. I had not, neither have I yet, any personal experience of the construction or repair of the "Dunlop" tire. I have "Points for Cyclists." I could easily have copied out what it has to say regarding tire repairing and sent it as *my* reply. I did not do so; first, because I had no practical knowledge of the process, and secondly, I do not consider the instructions there given sufficiently minute to guide anyone without other aid in the mystery of repairing these tires. There was an air of mystery surrounding the repair of these tires that does not now exist. The difficulty of repairing them still exists, however, and the necessity also; for the tire is admittedly even yet not perfect, and I think the art of repairing them is not worth the candle. I do not believe the tire has come to stay, and I do not care to spend time learning the mystery of repairing them, which at best is not a simple, but a ticklish job. I have also a book issued by the Pneumatic Tire and Booth's Cycle Agency. The instructions therein given are much more precise than in "Points for Cyclists," yet at the outset the latter book says: "If the rider has previously got a lesson in repairing, he will easily follow these instructions. If not, he must make sure that he understands the *construction* of the tire before trying to effect the repair." After describing the process of replacing a broken spoke, repairing a puncture, etc., about as well as it can be described in a book, it ends up with the following: "Customers of the Company will be instructed at the Company's offices, and in all the principal cycling centres agents have been, or will be, instructed, who, no doubt, will be prepared to show their respective customers how repairs *can* be effected." So, after all, a practical lesson is what is needed; and my advice to RETRENCHMENT, and all others who have the misfortune to possess a pneumatic machine, is to give it to a practical repairer. It will be cheaper in the end.—A. S. P.

Pocket Medical Coil.—A. E. J. (*Staleybridge*).—You evidently wish to have a small induction coil, small enough to go into a pocket and be worked by a silver chloride battery. The following dimensions will probably suit your requirements:—Core of No. 20 iron wire 3 in. in length, annealed soft and made into a bundle ⅜ in. in diameter. Cover the core with three layers of tough, thin paper, soaked in hot paraffin wax, and wind on two layers of silk-covered No. 24 copper wire; this is named the primary wire. Over this wrap two or three layers of the prepared paper above mentioned, then fill up the remainder of the 1½ in. bobbin (to hold the coil) with No. 34 silk-covered wire, well soaked in hot paraffin wax. A magnetic contact-breaker must be fitted to one end of the coil, to be actuated by the magnetised core. The two wires from the battery must be connected to the two ends of the primary wire, one end of which will go to a binding screw and the other to the foot of the spring carrying the armature of the contact-breaker. A wire from the pillar of the contact stud to a binding screw connected to the battery will complete the circuit. A stinging shock will be given by the two ends of the secondary wire when two silver chloride cells are connected to the coil.—G. E. B.

Kinetic Theory of Matter.—ELECTRA.—I do not know certainly that there is such a theory in existence, consequently I cannot recommend "a good book on the modern kinetic theory of matter." What you are pleased to name a theory is merely a mode of expression applied to a fact. Kinetic energy is merely a term used by some persons to denominate energy of motion. That is to say, when matter is in motion, the velocity of its movement is distinguished by the term "kinetic energy." The word "kinetic" has a Greek origin, and is applied to "that part of mechanical science which treats of motion without reference to the forces producing it." I quote the following from Ganot's "Physics":—"The energy possessed by a body in consequence of its velocity is commonly distinguished as *energy of motion* or *kinetic energy;* it is measured by half the product of the moving mass into the square of its velocity."—G. E. B.

Self-acting Fountain.—T. N. D. (*No Address*).—You can purchase a fountain as described in No. 69 of WORK in London for about 37s., but name and address cannot appear in the columns of "Shop." If you send your address under cover to the Editor, I will give you the necessary particulars.—C. M. W.

Compo Tubing.—W. J. (*Rossendale*).—It is surprising that you should find any difficulty in obtaining this article at an ironmonger's. The fact must be that they do not wish to sell it. Compo tubing is a well-known article, and in daily use by all gasfitters in small sizes as a substitute for lead pipe. Have you tried getting it at a gasfitter's?—C. M. W.

Iron Frame Piano.—W. H. C. (*Tipton*) and WOULD-BE PIANO MAKER (*Cape Town, S. Africa*).—The instructions given in WORK on "How to Make a Piano" were written so as to make the proceeding as simple as possible, but the instructions there given require very little modification to accommodate them to the construction of an iron frame piano. Your best plan would be to purchase an iron frame. This you can obtain, already drilled and pinned, from W. Hughes, of Drury Lane, London, W.C. A 3 ft. frame would suit you—that is, that it is 3 ft. from the bottom to the top edge, which fits under the bottom edge of wrest plank. The back would only require six bracings, as the frame resists a large amount of the strain. The bent side need not be made of beech; spruce will do, as the frame merely rests on it and is bolted to it. It would be trichord to the covered strings. Your bridges on the sound-board will require to be 1½ in. in thickness, and as there are breaks in the frame, or bars to strengthen it, your bridge would be in three parts, one part supporting the covered strings and the remaining two supporting the steel. Your back would be 4 ft. 3 in. wide, and add a 9-in. wrest plank, and let the back extend two inches below the frame. When complete, with top and castors, your piano would stand 4 ft. 1 in. high. If you make the top bridge on the wrest plank, a couple of octaves, with a double row of bridge pins, it will make your treble brighter. You might write to W. Hughes, of Drury Lane, London, W.C.; he would probably supply you with all the materials you require, and give you the cost, as they could be packed in one case. Any further particulars you may require, write again.—T. E.

Steps.—E. H. (*Rawdon*).—Our subscriber wishes to know if the method he adopted to set out a string-board is correct: it has led to a successful result, so it must be free from serious error. His sketch is scarcely good enough to print, but as he asks for a correct way to arrive at the desired end, we will remind him of first principles. The treads of stairs ought to be level, and the risers vertical; that being so, the riser and tread are at right angles to each other on the exterior surface. If, therefore—neglecting for the moment the overhang of the tread, and regarding the thickness of the tread as added to the riser—E. H. takes a piece of board, having the ends accurately squared, and sets off the net width of tread, and on the adjacent edge the gross rise (that is, riser plus thickness of tread), by joining the points thus obtained he will have drawn a right-angled triangle, the third side of which is parallel to the edge of the string-board. A board such as this is usually prepared as a preliminary to staircase making, and is called a pitch-board. E. H.'s steps are too steep to be convenient: it is rare for the rising to exceed the forward movement, though it is sometimes needful when space is very restricted. Authorities give various data for determining the proportion between riser and tread. Some say tread plus twice the rise should equal 24 in.: thus, 10 in. forward would give 7 in. upward movement; others say these figures, multiplied together, should give an arbitrary number: about 70. This 70 would agree with the foregoing. By the first rule, 11 in. tread would require 6⅓ in. riser, which, if multiplied as the second rule, would give 71½. Other examples will show that these rules are, after all, mere generalisations, and that a comfortable staircase is only to be had by consulting the average length of step of the human species. Examples—tread 15, riser 4½, by first rule; tread 15, riser 4⅝, by second; tread 9, riser 7½, by first rule; tread 9, riser 7¾, by second rule. These, of course, are extreme instances; in moderate cases the rules agree fairly. The rise should always

be equal in every stair between each floor.—B. A. B.

Organ Accordion.—G. T., J. B., and others.—This question must be treated in an article; the full description of how to make one of these is too long for "Shop." As some parts will be beyond the powers of an amateur to construct, we will find out if those parts are to be had at the musical fittings warehouse. Stands, reeds, and ivory for keys can be purchased, but some other parts offer difficulties not easily overcome.—B. A. B.

Damp in Cylinder of Electric Machine.—G. W. S. (*Biggleswade*).—You can only remove the dampness in the cylinder by warming it before a fire, turning the cylinder around as it gets warm. If the cylinder has wooden ends, drill a few fine holes in the wood to facilitate the escape of damp, and stop these with sealing-wax after the cylinder has been well warmed and you think all the moisture has evaporated.—G. E. B.

III.—Questions Submitted to Readers.

*** *The attention and co-operation of readers of* Work *are invited for this section of "Shop."*

Marionette Show.—Marionette writes:—"Can any correspondent give me instructions as to how to construct a marionette show, size of the stage, how to fit up, etc., and whether I could make the figures? I want to show it next season. As I am an invalid, and have no means of earning my living, I might work one of the above. I saw a model theatre representing the Spanish Armada. Which would be the easier to make—the marionettes or the theatre?"

Glass-Blowers.—Drofsaba writes:—"Will anyone inform me of the address of an experimental glass-blower who deals in glass rods and tubing; also manufacturer of chemical and scientific glass ware, incandescent lamps, etc.? The address given of Mr. D. Williams, p. 668, Vol. III., in reply to Draughtsman, is of no use, as he has removed from that address."

Embossing on Glass.—Bonâ Fide will thank anyone who knows to kindly explain the method of embossing on glass with lead foil.

Stain for Celluloid.—Ebony writes:—"Will any kind reader give me a recipe for staining celluloid (imitation ivory) a black colour? I have some I want to stain, and have tried several dyes, but without any good results."

A. S. L. Monogram.—R. R. (*Greenock*) writes:—"I would be very much obliged to any clever reader who would be kind enough to give me a design for the initials A. S. L., to be inlaid as a centre-piece on lady's workbox. The top of box is 13 in. by 9 in., and has a Chippendale border round the edge."

A. E. T. Monogram.—Shamrock—an Emerald lad—will thank any reader for a suitable monogram with the letters A. E. T. to fit the shield drawn on p. 700 of Work, Vol. III.—[As Shamrock takes particular pains to emphasise the fact of his being "an Emerald lad," and we want to help the Irish cause, perhaps M. (*Bishop Auckland*) or some other tried correspondent will come to the rescue.—Ed.]

Copies of Photographs.—Rectilinear writes:—"Will some reader of Work tell me how to get the best results in copying yellow and faded photographs, using ammonia, bromide of potassium, and pyro?"

Monogram.—T. W. T. (*London, N.*) writes:—"I should be obliged for a monogram for initials T. W. T. for painting on a Gladstone (brown) bag, ornamental preferred; also what kind of paint should I use? Would Aspinall's enamel or any other made-up paint do?"

Leather Work.—J. B. M. (*Blairgowrie*) writes:—"Will anyone tell me the best work on fancy and ornamental leather work? I have seen it made into picture-frames, brackets, etc. Also where is the best place to purchase the necessary tools, and their probable cost?"

IV.—Questions Answered by Correspondents.

Hand v. Treadle Fret-Saws.—W. E. C. (*Wakefield*) writes, in reply to W. M. (*Brixton Hill*) (see Work, p. 654, No. 146):—"As an amateur with a long experience with treadle machines, both of my own make and invention, as well as others now in the market, I have no hesitation in strongly recommending him to go in for a good treadle machine with a vertical stroke and an even tension spring, which prevents the unpleasant upper resistance of the spring. All those machines on the principle of the Rogers, Windsors, Lester, and others with the oscillating arms and circular stroke, are really useless where good work is required. If W. M. is not in a great hurry to get a machine, I should strongly recommend him to wait until the Britannia Co. send out their new and improved machine, which has been already noted in one or two papers. He will then have a chance of purchasing a machine that has no equal."

Market for Fretwork, Wall Designs, etc.—F. Standage (49, *Fifth Avenue, Queen's Park, Harrow Road, London*) writes, in reply to Fretworker (see p. 733, No 150) and T. W. (*Accrington*) (see p. 732, No. 150), to say that he is open to consider novelties in these lines.

Model Ship Building—Rig, etc.—M. (*Bishop Auckland*) writes, in reply to Cutter (see p. 733, No. 150):—"I suppose you want a cutter rig. Make mainmast 22 in. above deck, ¾ in. diameter; topmast 14½ in., $\frac{7}{16}$ in. diameter; bowsprit, 12 in. long, projecting 5½ in. over stem; jibboom, 17 in. long, projecting 10 in. over bowsprit, and tapering from ½ in. to $\frac{3}{16}$ in. diameter; spanker boom, 18½ in. long, ½ in. diameter, tapering to $\frac{3}{16}$ in.; gaff, 13 in. long, ⅜ in. to $\frac{3}{16}$ in. diameter; topsail-yard, 5½ in. long, $\frac{3}{16}$ in. diameter. If you lay these down to scale, you will get the size of the sails, the mainsail, foresail, and jibsails being attached to the mast just under the crosstrees. You will require eight single-sheaved blocks and one double-sheaved block, eight dead-eyes for main shrouds, and six smaller dead-eyes for the stays. You will also require some cleats, fixed either at the foot of the mast or on the bulwarks, to fasten the halliards for working the sails."

Naval Architecture.—M. (*Bishop Auckland*) writes, in reply to Art T. (see p. 733, No. 150):—"Perhaps one of the following would suit you: 'Iron Ship Building,' by J. Grantham, 4s.; 'The Forms of Ships and Boats,' by W. Bland, 1s. 6d., published by Crosby Lockwood & Son, London."

Engraving on Brass and Metal.—M. (*Bishop Auckland*) writes, in reply to Nelson (see p. 733, No. 150):—"You will find instructions for this, and description of tools, on p. 595, Vol. I., of Work."

Bamboo Flower Stands.—M. (*Bishop Auckland*) writes, in reply to Melton Constable (see p. 733, No. 150):—"You can procure bamboo from Mr. F. Westbury, Great Dover Street, Boro'. For making joints, plug the end, glue, and fix with screw or wire nail."

Fret Machine.—M. T. C. (*Watford*) writes:—"If W. M. (*Brixton Hill*) (see p. 654, No. 145) will try the Dexter C. Fret machine, he will find it all that he can desire. I have had one in use for the last three years, and it is a first-rate machine."

Cutter Yacht.—Eddifra writes, in answer to Cutter (see p. 733, No. 150):—"I have a 24 in. model cutter yacht. The spars and sails were calculated as follows: Divide length of boat into twelve equal parts, and step the mast at the fifth mark from bow, at right angles from water-line. Let the mast rise above the deck just double as far as it stands from the bow. Let the bowsprit project beyond the bow the same distance the mast is stepped behind it. Let the mainboom be the same length as the mast rises above the deck, and let it slant upwards a little to clear water when the vessel heels. The length from the stern to the tip of the bowsprit will give you the height the topmast-head should be above deck. For the sails, halfway between stem and stern draw a line parallel to the mast half as long again as the length over all, or, in other words, three times as long as the distance between the line and stem and stern. From the end of this draw one line to the end of mainboom, and another to the bow. In the line to the boom take a point at the same distance from the top as the topmast projects beyond the mast; halfway between, where the line to the bow cuts the topmast and the deck, take a point in the lower mast: joining these you will get your mainsail, with gaff at its proper angle. The jib you get by joining the head of the lower mast with the end of the bowsprit; the foresail by drawing a line from the crosstrees to the bow. The line drawn to the bow from the perpendicular parallel to the mast gives you the position and angle of the topsail-yard, which, on the bow side, should be as long as the distance down the yard from the perpendicular to the mast, and on the stern side just as long as the part of the bowsprit which projects beyond the boat's bow. A line from where the yard crosses the topmast will give you the stay for the jib topsail. Perhaps this will be a puzzle to you, but if you will draw it full size, you will, I think, be able to work it out."

Breeding Cage.—F. H. (*Battersea*) writes, in answer to Gamma (see p. 702, No. 148):—"I would advise Gamma not to make a fancy breeding cage if he intends to keep birds in it. A fancy cage will give him endless trouble. A breeding cage should be made as plain as possible, avoiding all fretwork—in fact, as little wood as possible should be employed. If Gamma wishes to make a model of a Gothic building, let him do so by all means; but make a breeding cage for the comfort of the birds, and not for show. For making breeding cages, see Nos. 54 and 80 of Work."

V.—Letters Received.

Questions have been received from the following correspondents, and answers only await space in Shop, upon which there is great pressure:—A. R. (*Scorrier*); J. B. (*Keighley*); W. K. (*Watford*); A. C. (*Falfield*); J. Y. (*Woolwich*); G. A. M. (*Partick*); F. J. (*Oldham*); W. Y. B. (*Deptford, S.E.*); F. H. R. (*York*); Reader (*Aberdeen*); A. T. (*Sheffield*); J. H. (*Walsall*); J. C. (*Altrincham*); F. A. G. (*Sheffield*); G. E. W. (*Upper Tulse Hill*); Limited Means; F. S. (*Deptford*); W. B. (*York*); G. T. (*Newport, Mon.*); A. W. M. (*Holywood*); W. J. (*Glasgow*); G. L. (*Birmingham*). W. H. E. (*Redruth*); R. G. H. (*Richmond, Var.*); A. J. S. (*Canterbury*); A. B. (*Blackburn*); C. T. (*Edinburgh*); H. J. (*Blackburn*); J. J. (*Blackpool*); S. L. (*Sydney, N.S.W.*); W. T. (*Birmingham*); T. S. (*York*); J. J. (*Walthamstow*); E. C. (*Birkenhead*); J. B. (*Fourstones*); T. W. (*Silloth*); John; S. S. (*Salford*); B. H. (*Batley*); G. T. (*Birmingham*); B. H. (*Colne*); J. G. (*Edinburgh*); F. C. (*Bath*); Electric; E. H. (*Rockferry*); Eddifra; A. G. (*Sheffield*); Iron; H. Mog. (*Cork*); Pen; F. H. (*West Ham*); J. T. (*Sunderland*); C. H. W. (*Erith*); Tip; D. M. L. (*Waterloo Road*); W. H. H. (*Colne*); F. J. B. (*Newton*); J. E. R. (*Limavady*); J. R. S. (*Liverpool*); Utiledulci; D. T. (*Liverpool*); J. H. W. (*New Brompton*); P. T. (*Birmingham*); A. D. (*Sheffield*); M. (*Prince's Park*); E. P. (*Birmingham*); V. L. (*Bayswater*); C. P. (*Primrose Hill Road*); Cymro; Woodbine; N. N. (*South Stockton-on-Tees*); F. J. (*Exeter*); T. T. (*Sefton Park*); W. R. (*Mill End*).

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Tools of every description at Clarke's Tool Stores, Fore Street, Exeter. Illustrated catalogue, 1 stamp. [21 R

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